TOOLING & PRODUCTION Magazine

AUGUST 1959

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**New System for Automatic Grinding
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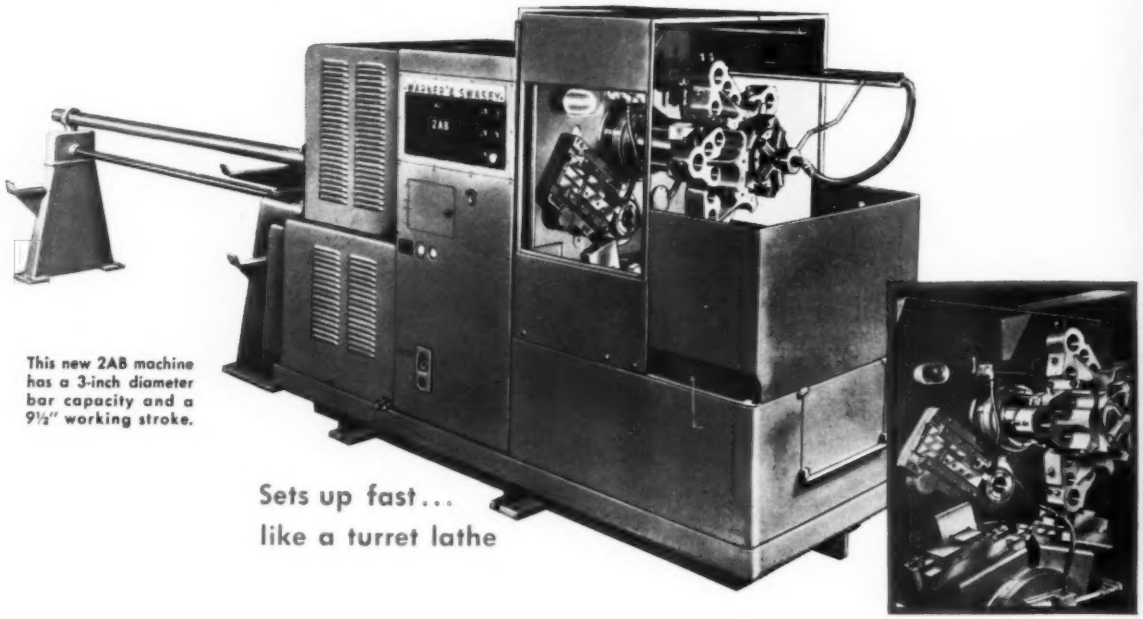
NEW! Warner & Swasey 2AB Single Spindle Automatic Bar Machine

...provides fast, automatic production of short, medium, or long-run precision bar jobs



This new 2AB machine has a 3-inch diameter bar capacity and a 9½" working stroke.

Sets up fast... like a turret lathe

Now, the shop-proven, cost-cutting features which have made Warner & Swasey Automatic Chuckers so outstanding in their field are available in a new Single Spindle Bar Automatic. Most important among the profit- producing features of this new Warner & Swasey 2 AB are:

- **FASTER SETUPS**—With no cams to change, time-consuming set-up procedures, usually encountered with automatic bar machines, are eliminated. Even your smallest lot bar jobs can now be produced economically on an automatic basis.
- **GREATER ACCURACY**—Only two wide—and widely-spaced—bearing surfaces support the turret. Thus, cumulative tolerance problems in conventional "multiple bearing" turret location designs are eliminated.
- **EASIER TOOLING FOR COMPLEX WORK**—Flexibility and accessibility of the 2 AB's cross slides and pentagon turret enable the use of a wide variety of machining methods. One operation usually handles even the most complex workpieces.
- **POWER FOR TOMORROW'S JOBS —TODAY**—The 2 AB's 25 horsepower, reversible motor more than meets today's rugged metal removing requirements and, coupled with a wide range of spindle speeds, permits the efficient application of the latest cutting tool materials.
- **"FREE" CUT-OFF TIME**—An independently-operated cut-off slide allows full utilization of both front and rear cross slides. The cut-off cycle may be started during any one of the pentagon turret stations. Thus, cutoff can be progressing during subsequent machining providing a cut-off cycle which is virtually "free".
- **AUTOMATIC RESTOCKING INDICATOR**—This ingenious device in the hydraulic bar feed mechanism automatically stops the 2 AB and lights an indicator light on the operator's control panel before the bar being machined runs out—prevents tool damage from improperly-gripped stock.

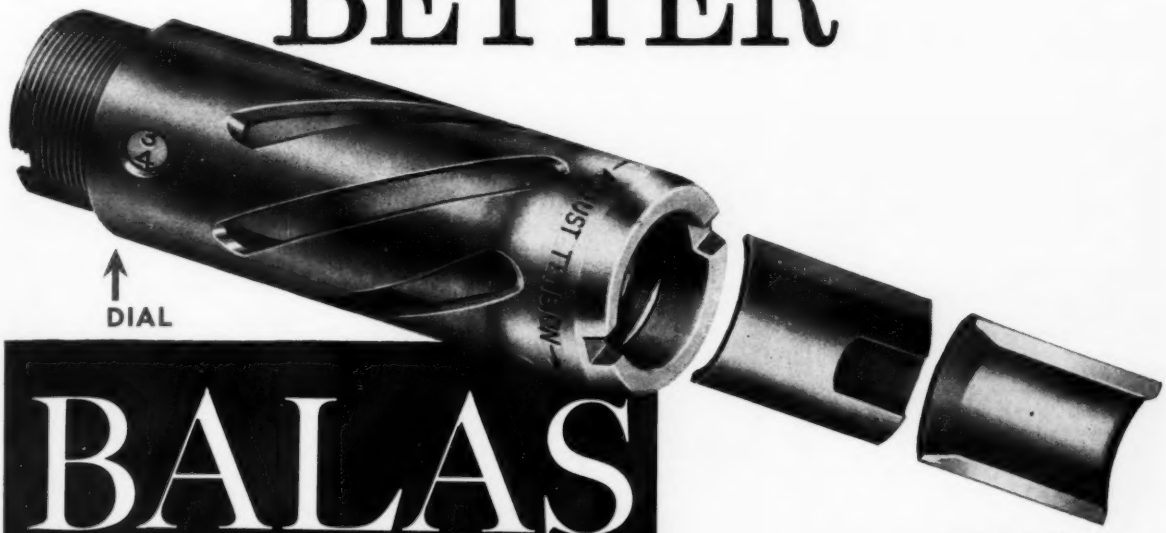
Why not call your nearest Warner & Swasey Field Representative and get the complete story on the new 2 AB. It can help increase both production and overall profits—so important in today's highly competitive picture.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

NO MATTER WHICH WAY YOU TURN...WARNER & SWASEY CUTS COSTS

CIRCLE INFORM-A-GRAM KEY NO. 2

NEW DIFFERENT BETTER



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MASTER PUSHERS

WITH THE DIAL THAT MAKES TENSION SELECTION EASY

YOU NEVER HELD IT SO GOOD!

You'll greatly reduce down-time . . . get better performance from your automatics and cut scrap losses when you use Balas *Dial* Adjustable Tension Pushers.

The unique method of maintaining tension in this Balas Pusher guarantees months of continuous operation regardless of the number of pieces produced.

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When Balas Solid Carbide Pusher Pads are used in these pushers wear is practically non-existent . . . galling and scratching are eliminated. Bronze, cast iron, Meehanite or steel pads may also be used.

Try these Adjustable Tension Master Pushers in your automatics now . . . you'll be time and money ahead.

Prices and descriptive literature sent upon request.

BALAS COLLET MANUFACTURING CO.

CLEVELAND 14, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 3

want to improve your finish?

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Starting with the best Diamond wheel is not enough . . . it's the finish that counts. It costs you nothing to make more profit in your grinding operation.
PRESSURELOK builds optimum performance into every United States Diamond Wheel —yet your carbide grinding costs may be reduced by using a different type, size, grit or hardness of wheel from which you are now using.
United States Diamond Wheel Co. is pioneering on-the-job "Progressive Specification" to warrantee you the top carbide grinding efficiency.

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THE PERFORMANCE BOND

This wheel is a precise duplication of your specification, warranteed when properly operated, to give you the lowest cost per cut of any wheel.

Write for our catalog No. 957 or call us at Aurora (Illinois) 7-9181 for "Progressive Specifications" on your job without any obligation on your part.

US UNITED STATES DIAMOND WHEEL CO.

835 ILLINOIS AVENUE AURORA, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

AUGUST 1959
VOL. XXV No. 5
GEORGE J. HUEBNER, Founder
1885 - 1956

PERSONALLY SPEAKING

Dear T & P Reader:

Recently I had a first hand look at a new Jones & Lamson development that has enormous significance. It is their use of the mercury arc lamp in comparators. J & L has found a way to make the mercury arc behave so that the image is completely stable on the screen. The increased brilliance of the light put out by the mercury arc greatly expands the use of the comparator. There is an article in this issue describing a J & L development of some years ago which has not previously been much talked about. The subject is Quality Pre-Control. The brilliance of the new mercury arc lamp permits such a step-up in magnification that visual measurement to tenths becomes easily possible. You will want to read the article in this issue about Quality Pre-Control and by all means see for yourself as soon as possible a demonstration of the new J & L mercury arc illumination.

The Norton Company has gone into the centerless grinder field. I saw their new No. 2 machine recently at Worcester. A few details of this new machine are described and illustrated elsewhere in this issue. With the Norton name plate on this machine it can't help but be one of the best. Of course, there are some very excellent centerless grinders already available so anyone bringing out a new one would be hard put to achieve anything spectacular. The special claim for this unit is its capability of processing piece after piece with absolutely insignificant dimensional variation.

Six or seven years ago, a good friend of ours, who was both a reader and an advertising customer, suggested we explore the feasibility of addressing copies of Tooling & Production Magazine directly on one face of the magazine. We found a way to do this but, of course, it necessitated doing something else. We had to eliminate envelopes. At the time of our study, however, we actually found that the elimination of the envelope was a plus value because postal employees saw that they were handling a high quality magazine and as a result their handling was more careful. Actually, undeliverable copies coming back to us in envelopes were badly broken, whereas those not in envelopes came back in good shape.

In the past few years there have been some changes in the Post Office. The considered opinion of many people is that postal service has deteriorated considerably. As a matter of policy, the Post Office Department expects to have all mail handled considerately so that it doesn't get broken and beaten up enroute. As far as we know, most of our copies arrive in your hands in good order. If they don't we'd sure like to know about it because if we make a complaint to the Post Office Department, a conscientious effort will be made to correct the cause of the difficulty. So, please, if you have any copies reach you that appear to have had unreasonably rough handling, let me know. Best of all, of course, would be if you would send your bad copy to me. I'll see that you get a good one in place of it, of course.

Cordially yours,

Ray Huebner

Publisher

READERSHIP Control RESEARCH

BPA

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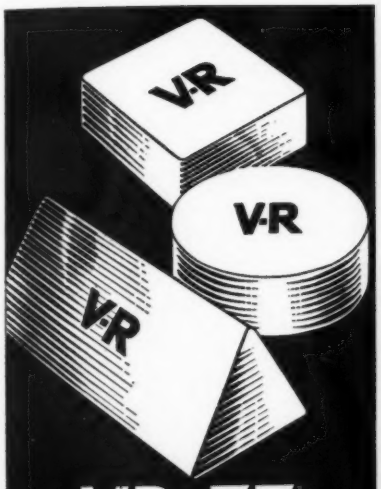
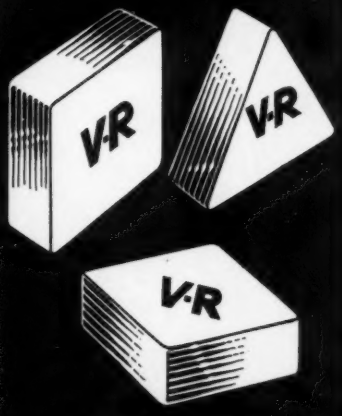
You wouldn't play right field with a catcher's mitt . . .

playing ball or cutting steel,

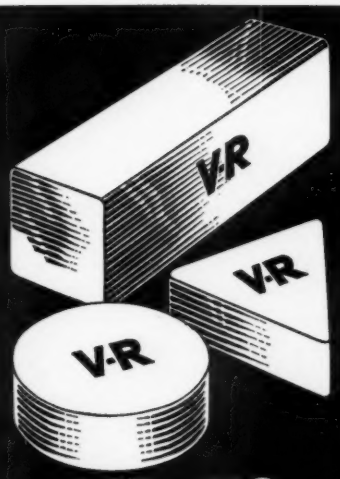
use the "tool" designed for the job!



VR-77
for heavy roughing and interrupted cutting

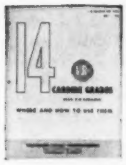


VR-75
for medium roughing and general purpose machining



VR-73
for finish machining and light roughing

Each carbide grade has been specially engineered and field proven for the correct balance of wear resistance, shock resistance and heat resistance to handle a specific range of operations. These superior V-R carbide grades cover the complete range of operations for machining all types of steel and the new superalloys . . . setting new standards of carbide tooling performance in hundreds of plants. V-R engineers will be glad to help you select the carbide grade engineered for your job. Contact your nearest V-R representative or write for complete information.



Ask for Bulletin No. 5803 on V-R grades

Vascoloy-Ramet corporation

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

C-744

822 Market Street • Waukegan, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 5

PROBLEM

How to get used to rush jobs again

Threadwell

MAKES THE BEST PRODUCT BETTER

INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION

One good way to stay on top of the job is to standardize on Threadwell cutting tools and gages which relieve the worry about down time and rejects. Uninterrupted production and precision machining are Threadwell specialties. Convenient warehouses and a network of national Distributors take care of fast delivery, too. . . . and your Threadwell Field men and Distributors are glad to rush to give you a hand in production planning.

THREADWELL TAP & DIE CO.
GREENFIELD, MASSACHUSETTS

Stocking Warehouses: New York — Cleveland
Detroit — Los Angeles — Greenfield, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 6

Talks of the Month

The Big Squeeze on Little Steel

*by Alwin F. Franz**

INFLATION HAS BROUGHT WITH IT INCREASING COSTS, a rapid growth in foreign competition, inadequate depreciation allowances and, in some instances, the overseas migration of American business. These developments are challenging all American steel companies, both large and small.... I would like to discuss with you their impact on the smaller companies.

Rising Costs

In spite of the present high operating rate, and the good financial performance of the steel industry during the first quarter of this year, we are all aware that steel production costs are constantly increasing.... Rising costs were, to a great extent, recouped through higher prices. But, in the past two years, it has become progressively difficult to raise prices in order to compensate for higher costs.... Continued price increases can no longer be counted on to recover rising costs....

With rising costs and little prospect of adequate price relief, the industry, and particularly the smaller steel companies, is faced with serious difficulties.... Costs must be kept in line and, if possible, reduced—for, with price limitations, any increase in costs will further squeeze profit margins.

* * * *

The attack on costs can be made in two ways: First, by fully modernizing plant and equipment to take advantage of the latest developments in technology, and second, by keeping operating costs at a reasonable level.

A realistic tax policy should be adopted permitting us to recover the purchasing power of the original investment. This can then be reinvested in modern equipment, and thus help reduce the cost of production....

* * * *

Modernization Important

Plant modernization is of paramount importance to the smaller steel companies who must rid themselves of obsolete facilities in order to maintain a competitive position. To modernize, their earnings must be maintained at a level sufficient to supplement inadequate depreciation charges, and, for the present, if costs go up, price relief is imperative to

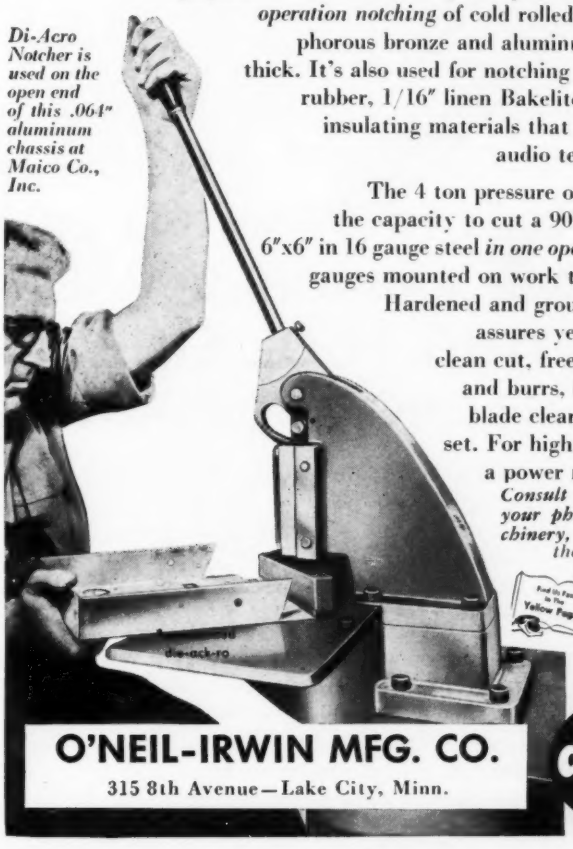
...Continued on page 8

*President Colorado Fuel and Iron Corp., Denver, Colorado. Given at General Meeting of American Iron and Steel Institute.

DI-ACRO* NOTCHER Speeds Production, Saves Extra Operations on Chassis Work

"I use our Di-Acro Notcher for practically everything," says V. Johnson of Maico Co., Inc., Minneapolis manufacturer of hearing testing equipment. "This machine speeds production—*provides one operation notching* of cold rolled steel, brass, phosphorous bronze and aluminum up to 16 gauge thick. It's also used for notching fish paper, sponge rubber, 1/16" linen Bakelite and other circuit insulating materials that go into chassis for audio testing equipment."

Di-Acro Notcher is used on the open end of this .064" aluminum chassis at Maico Co., Inc.



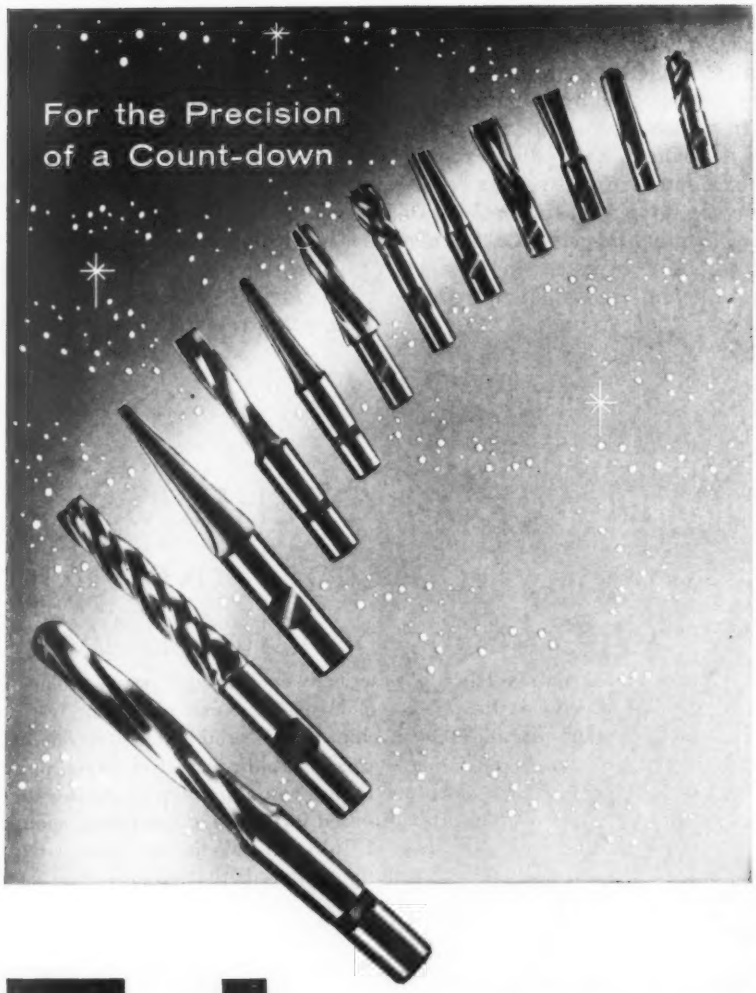
The 4 ton pressure of this machine has the capacity to cut a 90° notch as large as 6"x6" in 16 gauge steel *in one operation*. Adjustable gauges mounted on work table are standard. Hardened and ground triangular ram assures years of precision. A clean cut, free from rough edges and burrs, is possible because blade clearance can be easily set. For high speed production, a power model is available.

Consult the Yellow Pages of your phone book under Machinery, Machine Tools for the name of your nearest Di-Acro distributor or write us for Quick Facts Folder describing this and other Di-Acro machines.

O'NEIL-IRWIN MFG. CO.
315 8th Avenue—Lake City, Minn.

di-acro PRECISION METALWORKING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 7



T-J LAUNCHES A NEW
CUTTING TOOL LINE
FOR MILLING ACCURACY

For precision milling to close tolerances, so vital in today's high-speed, high-production manufacturing, T-J now offers a new, improved line of milling cutters. The new cutter line features a high helix angle, double back-off, and a right-hand spiral to produce more and smoother cuts between grinds, and a free-cutting, stronger tool.

Specially designed and precision-manufactured for die sinking and production milling, the new line is designed to include flats on the shanks for set screw type drivers on all of the end and side milling cutters. Write today for complete information to the Tomkins-Johnson Company, Jackson, Mich.

Ask for completely new cutter catalogue No. 259.

T-J TOMKINS-JOHNSON
RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

CIRCLE INFORM-A-GRAM KEY NO. 8

. . . Month's Talk from page 7

maintain these earnings. In fact, the smaller companies will be in greater need of price relief than the larger ones, for many of them have not had sufficient capital to modernize their plants fully.

This is an item congressional committees do not seem to realize. In their attempt to bring pressure on the industry to keep prices down, they direct their attack against those companies who have had the capital to invest in new facilities and who have reaped the rewards of modernization through lower costs. They seem to forget that the smaller steel companies have not modernized to the same degree and so have higher costs which require price increases to cover these costs. Therefore, by keeping the price down when costs go up, the protectors of the small business man have, in reality, been squeezing his profits to an alarming degree.

Another result of the increase in the cost of production is the construction of plants by American companies in foreign countries. . . . They have apparently concluded that a combination of American production efficiency and foreign wages provide a solution to at least some of their problems. American-owned overseas manufacturing facilities now total billions of dollars.

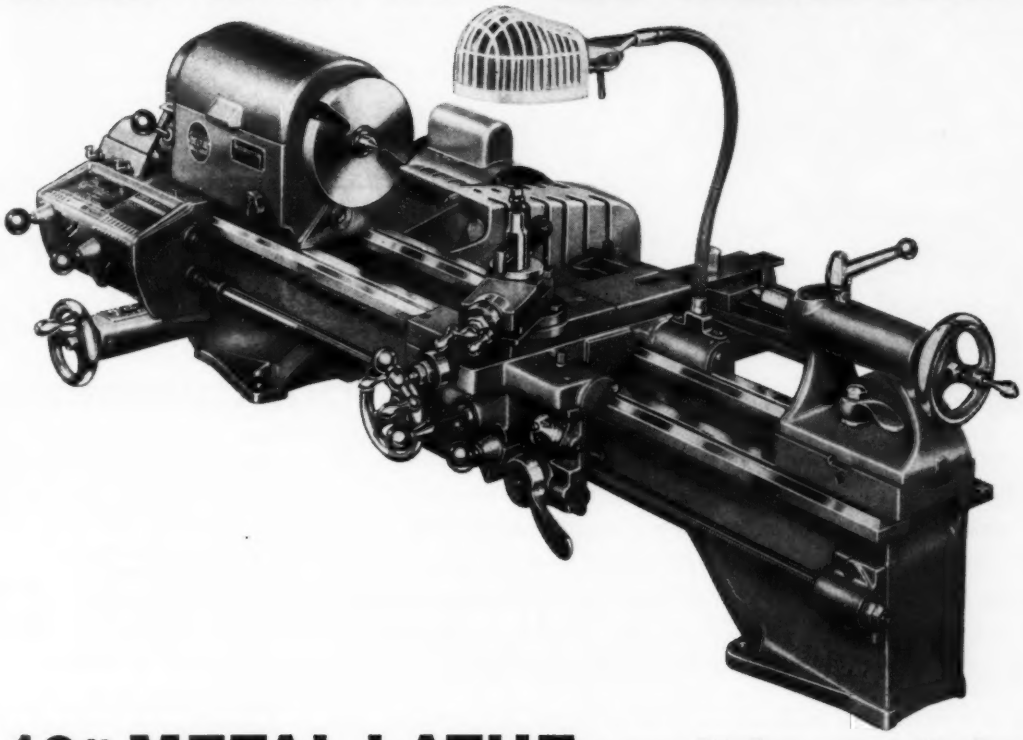
Our government is being urged to give a better tax rate to domestic corporations who would do most of their business abroad, [but this]. . . will only accentuate the problem of protecting American jobs, and any tax reform should first be applied in this country.

Foreign Competition

Foreign competition has become a problem of growing importance during the past two years. In many respects, its remarkable growth can be attributed to rising costs in the United States. . . . The plain facts are—

. . . Continued on page 11

NEW from DELTA



10″ METAL LATHE can't be matched for performance, capacity, or real value!

The many items of standard equipment *include* variable speed drive (complete with belts) and thread chasing dial at no extra cost. Specially designed, extra rigid Delta bench and complete line of accessories also available.

You'll like everything about this all-new Delta 10″ Lathe—its modern look, on-the-job performance, and the low price—just $645.00! Designed for industry, schools or home workshops, it fills the need for a safe, low cost, precision lathe with heavy-duty capacity.

And you get this exclusive combination of Delta Quality features never before available on a lathe this size at comparable cost: variable speed drive, ¾″ collet capacity, massive, double row, precision ball bearing at the work load end of the spindle.

SEND FOR NEW LATHE CATALOG—Pictures, describes and catalogs the new 10″ lathe plus the complete line of Delta Metal Lathes and full range of accessories. For *free* copy and list of Delta Lathe Dealers write: Rockwell Manufacturing Company, Delta Power Tool Division, 622H N. Lexington Ave., Pittsburgh 8, Pa.

DELTA METAL LATHES
another fine product by
ROCKWELL

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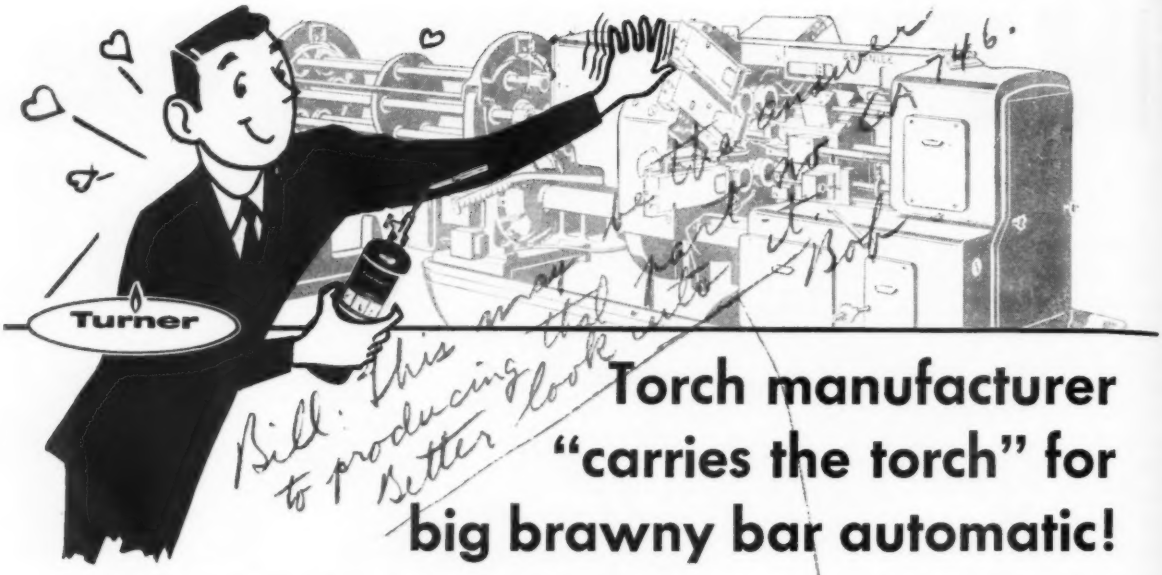


Torch manufacturer "carries the torch" for big brawny bar automatic!

Growth of a company from the founder's first fond dream to a leading place in the industry is a matter of continuing product improvement, sound management, ever-increasing efficiency, keeping pace with changing times. Read what a line of machines named Greenlee means to a company named Turner . . . and why, out Sycamore-way, they "just love those Greenlee Bar Automatics" . . .

The Great Fire of 1871 struck and scarred Chicago the very same year that enterprising Edward S. Turner "hung out the shingle" at 4 LaSalle Avenue and proclaimed to one and all that The Turner Brass Works was ready for business.

It's a long way from the Horse Age to the Age of H-Power . . . 1871 to 1959. A whole way of living changed, new products came to the fore. Alert, trend-conscious Turner kept pace with the advancing times, moved the factory to Sycamore, Illinois in 1906 . . . expanded its operations steadily until today the Turner Corporation spans 100,000 square feet of factory space, and turns out products ranging from propane torches to plumbing fixture fittings—blow torches to diesel engine starting aids—camp cook-stoves and lanterns to furnaces and furniture hardware.

Along that route Turner continually met the old familiar problem: *How to get high-speed production and maintain top quality.*

That's where Greenlee enters the picture, and the Case of the Propane Torch is a typical example. It's a "How-They-Dunit" that may hold eye-opening suggestions for some of *your* production problems.

Turner's Propane Torch suddenly became a "hot" item — hot as its glowing tip. An expanding nation-wide need for it in home and shop at length blossomed into an enormous increase in demand. The order went out: "Turn 'em out faster — but keep quality up — keep cost in line." How to do it was the question.

Turner management launched an exhaustive investigation of top-rated production machines on the market. They probed, tested, ran trial runs. Eventually they found a machine that seemed to do everything they asked. It took 9/16″ round brass stock, gave it a merry whirl — 298 surface feet per minute on stock diameter—2029 revolutions per minute.

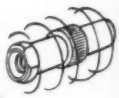
Quality tested consistently high, rejects were held to a minimum, a complete operation was eliminated, as the husky Greenlee Bar Automatics "rolled 'em out" with the tireless gait of a 'round-the-clock marathoner.

That's when a long and happy association began. For shortly thereafter, the Turner P.A.'s signature was on a purchase order for a battery of Greenlee Automatics with special attachments.

A look at the Job Progress schedule will give you an idea of how efficiently they tick off a 6-stage operation on mixer tubes:

1st Position:
The big Greenlee Cam-Feed 1-5/8″ Six-Spindle Bar Automatic uses a 1″ tool slide stroke with .0063 inch feed on the endworking tools. Stock is fed out to length during indexing, spot-drilled, knurled (using a standard plunge-type knurl holder and a two-roll roller rest)

2nd Position:
The mixer tube is faced by a knee turner while a .277 inch diameter drill, mounted on a high-speed drilling attachment, drills to depth.



3rd Position:
Outside diameter is sized by a standard dovetail form tool. A .187 inch hole is drilled partway, as a two-roll roller rest supports the part.

4th Position:
Using a standard milling attachment mounted on the tool slide, the two parallel flats are milled. (Attachment consists of two milling cutters mounted on a keyed arbor in the milling head). Milling head rotates at the same r.p.m. as the workpiece; internal gearing in the attachment rotates the milling cutters at proper speed for the milling cut.

5th Position:
The .187 inch hole is drilled to depth while a standard cut-off tool breaks down for cut-off.

6th Position:
A 5/16″ — 27 thread is tapped, and the part is cut off.

FINAL SCORE:

580 high-quality mixer tubes per hour at gross production rate. One complete operation eliminated. Rejects at an all-time low. . . . No wonder, out Sycamore-way, they "just love those Greenlee Bar Automatics" — big — brawny — and *bears for the jobs where you've got to keep your quality reputation as you keep up with market demand.*

Question:
Have *you* looked into Greenlee, lately, for quality on a production basis?

GREENLEE BROS. & CO.
1867 Mason Avenue
Rockford, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 10

...Month's Talk from page 8

many foreign firms are well managed, aggressive and now have modern facilities. In a number of cases, their productive efficiency is equal to our own, and represents a serious competitive threat to our steel markets, both at home and abroad.

* * * *

...It has been said that exports and imports represent a relatively small percentage of total shipments in the industry. Yet some companies and, for the most part they are small companies, have been severely affected. It seems to me, however, there is a factor involved here far more significant than tonnages and percentages. It is simply this—the American steel industry in certain areas is no longer competitive with the rest of the world!

* * * *

Remember this: Curbing inflation and keeping American production competitive is not a problem for steel management alone. It is also labor's problem and the public's problem! If our costs keep rising we will be faced with unemployment, a loss of business, and such a drastic decline in profits that the economic health and stability of our industry will be threatened.

This is a year of decision! If we can keep costs in line now, and for the next two or three years, and if we are able to get the proper depreciation funds to modernize our plants, we can better meet competition and solve the problems now facing the American steel industry, as we have in the past.

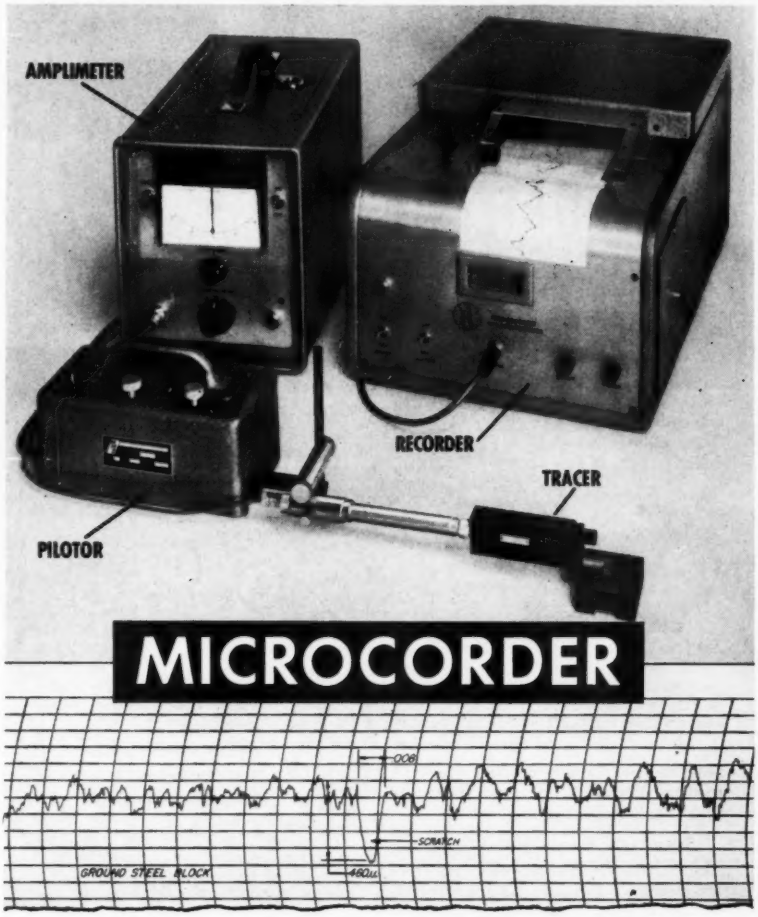
Deaths

Herbert W. Hansen, 54, eastern sales manager for The Producto Machine Co., died April 10.

Byron Frank Bower, 63, founder and president of Pines Engineering Co., died May 5.

Elmer Ellstrom, Sr., 72, founder of Dearborn Gage Co., died May 9.

Presenting A NEW INSTRUMENT FOR SURFACE INSPECTION AND CONTROL



THE MICROCORDER draws a magnified roughness profile of ID, OD and flat surfaces, for any length of trace up to 2¾". From its 4"-wide chart you can readily measure the *peak-to-peak spacing* and *peak-to-valley height* of roughness irregularities — and the *width* and *depth* of pits, scratches, chatter marks and surface porosity. A wide range of magnifications is provided.

This instrument is as simple to use as a TV set, and is equally at home in shop, lab and inspection department. It is used on metals, paper, plastics, ceramics and many other materials; and it is made and guaranteed by the *pioneers* in surface-measurement instrumentation.

Detailed specifications are given in Bulletin LT138. May we send you a copy? Write —

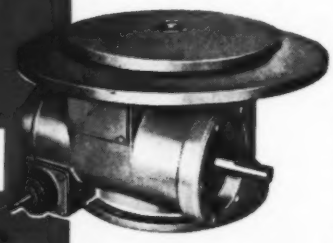
MICROMETRICAL MANUFACTURING COMPANY
345 S. MAIN ST. ● ANN ARBOR 8, MICHIGAN

Manufacturer of the PROFILOMETER®, PROFICORDER®, MICROCORDER, WAVOMETER®, ANDEROMETER®, VAROMETER, CHART VIEWER • Exclusive American Sales Agent for CENSOR Dimensional Gaging and Sorting Equipment

CIRCLE INFORM-A-GRAM KEY NO. 11

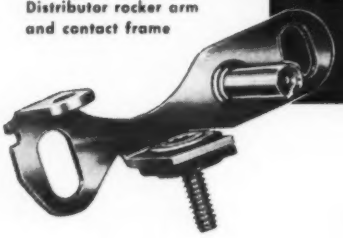
HIGH SPEED ASSEMBLY with Standard Tool Indexing Units

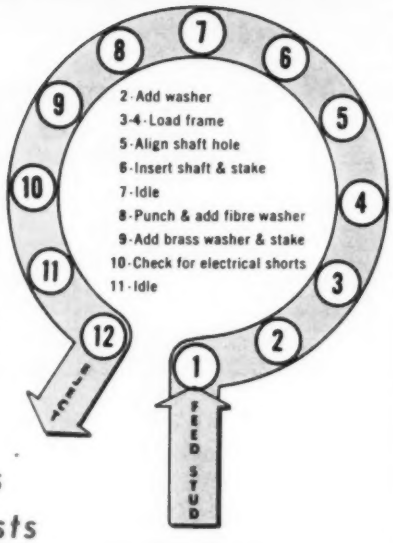
Typical 12 position Model ST-A9 Indexing Unit with precision shot pin locating



Floyd Lyon, Vice President of the Halm Instrument Company, Inc., says:
"We have had fine service experience and virtually no maintenance with Standard Tool indexing units—We have many in service over four years without fault."

Distributor rocker arm and contact frame





● At the right is illustrated the operations performed on a recently designed Halm high speed assembly machine. All working units at index stations are cam operated from the index unit cam shaft.

Standard Tool Indexing Units, "The Heart of Automatic Machines" are available in many sizes and types to solve most automatic production problems.

Better Products at Lower Costs thru Better Methods!

Technical Booklets Sent on Request!

Standard Tool engineers will be pleased to help you in selecting the indexing unit to meet your exact requirements.

Also ask for Standard Tool facilities brochure.

STANDARD TOOL & MANUFACTURING CO.

251 LAUREL AVENUE KEARNY, NEW JERSEY

STANDARD TOOL AUTOMATION

Since 1910

CIRCLE INFORM-A-GRAM KEY NO. 12

The Machine Sales West, recently formed subsidiary of The Torrington Mfg. Co., is headed by **M. A. Joulsohn,** vice president and general manager of the Western Division. Field sales activities of the subsidiary are supervised by **William McFarlane.**

Two new sales representatives have been appointed by The N. A. Woodworth Co. **George W. Duke** takes over northern and eastern Ohio and **George T. Lott** serves in southern Ohio and Kentucky.

Neil E. Funk, Jr., has been named manager of industrial sales west of Ohio, and **Raymond Means** now manages Ohio and the eastern states for Eli Lilly and Co.

New manager of the Detroit office of B. C. Ames Co. is **Cecil C. Sprung.**

Rodger Timmer now serves as district sales engineer for Lemmon & Snoap in Wisconsin, Illinois, and Indiana.

Taking over as sales manager of The Punch Division of Pivot Punch and Die Corp. is **Robert L. Bristol.**

Walter R. Ebling is the new market and product analyst, the Metallurgical Products Department, General Electric Co.

The newly created position of domestic sales manager of Jones & Lamson Machine Co. has been assigned to **Kenneth A. Henn.** His former position of manager of the Detroit office has been taken over by **Lewis Bernardini.**

The Jarvis Corp. has announced the appointment of **Donald O'Reilly** as sales manager of their Machine Tool & Attachment Subsidiary.

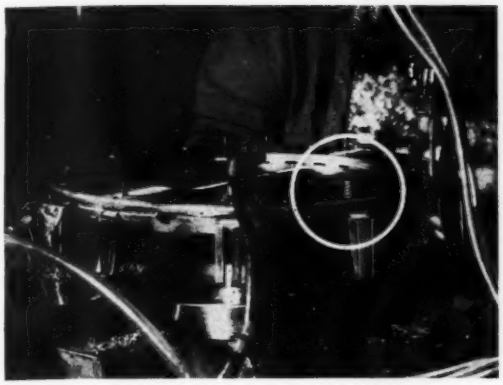
Now serving as field engineer in Philadelphia for Geo. T. Schmidt, Inc., is **Charles M. Conover.**

... Continued on page 14

Practical Tooling Tips

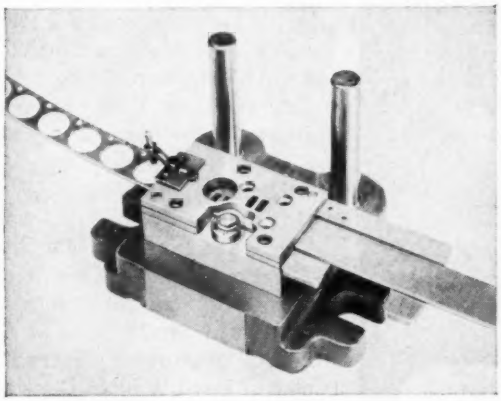
No. 3 of a series

Are your tool makers wasting time making complicated tooling gadgets when a standard, off-the-shelf Vlier part could do the job much better? Why not examine your present drawings and see where these simple, low-cost parts can be used. You will be amazed at the savings possible.



PRODUCTION INCREASED 300% when this 12-station automatic indexing and tapping fixture was put to work. Vlier Spring Plungers allow the operator to load by simply pushing the part into a slot. These simple, spring-loaded tools also position the part for the tapping operation. Available in four models; fifty sizes.

NEW SWIVEL PAD-TORQUE THUMB SCREW combines the Vlier Torque Thumb Screw and Swivel Pad Clamp. The result is a perfect holding tool—one that applies only the right amount of holding pressure without damaging the finished surface. Unique ball joint construction of the pad permits adjustment to off-angle surfaces.



PROPER STOCK ALIGNMENT IN PROGRESSIVE DIES becomes a simple task with the new Vlier Stock Pusher. Saves pilots. Mounts in tapped hole. Accommodates stock as thin as .010"; width variations totalling 1/16". Nothing to wear out or foul up.

NEW 1958 CATALOG NOW AVAILABLE—Eight pages; completely revised. Includes information and specifications on all new Vlier products, including the Torque Handle, Stock Pusher, Leveling Pad. Makes ordering easy. Suggests new uses for these proven time-savers. Write for your copy today!

VLIER
Engineering Corporation
A subsidiary of Barry Controls, Inc.
8900 Santa Monica Blvd. • Los Angeles 46, California

CIRCLE INFORM-A-GRAM KEY NO. 13

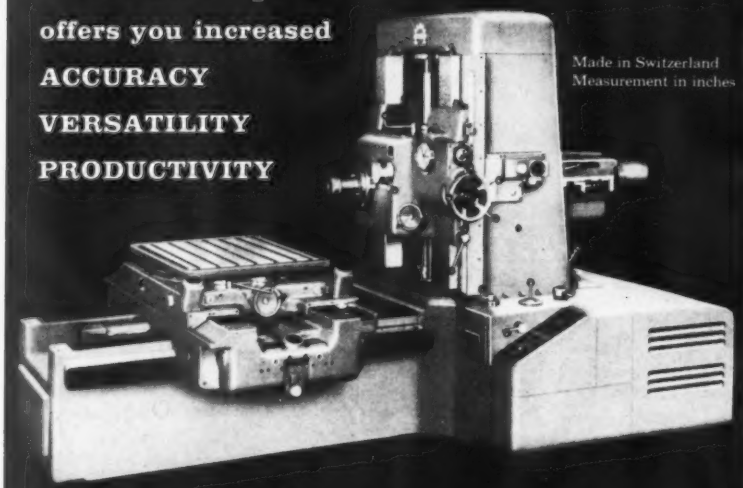
Now

AUTOMATIC POSITIONING

with the

DIXI 75 horizontal optical jig borer

offers you increased
ACCURACY
VERSATILITY
PRODUCTIVITY



- Automatic positioning can be changed instantly to manual operation
- Projected optical setting — direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29⅝" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.—Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

Demonstrations upon request at our conveniently located demonstration centers.

MBI

M. B. I. EXPORT & IMPORT LTD.

A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N.Y.
"Over 25 years' experience in designing and building machinery."

CIRCLE INFORM-A-GRAM KEY NO. 14

... Calling Cards from page 12

Geometric-Horton Division of United-Greenfield Corp. has made known the appointment of **Kenneth M. Chakiris** as sales manager, with headquarters in New Haven, Conn.

William L. Martin has been appointed by the Chrysler Corp. as sales manager of the Amplex Division.

New vice president and director for Cincinnati Milling and Grinding Machines, Inc., is **Robert C. Bevis.**

S-P Mfg. Corp. announces the appointment of **Richard E. Sutherland** as sales manager and **J. Harry Adams** as northern Ohio district sales manager.

The Coated Abrasive Division of Behr-Manning Co. is now under the direction of **Thomas Trowbridge,** newly appointed general sales manager, with **Thomas G. Gilcoyne** as field sales manager.

Officers Elected

American Society of Tool Engineers and the National Screw Machine Products Association recently elected officers for 1959-60. ASTE's include President Wayne Ewing, Arrowsmith Tool & Die Co.; H. Dale Long of Scully-Jones Co., William Moreland of F. E. Myers & Bros. Co., David A. Schrom of Grantely Works, York Division, Borg-Warner Corp., and Philip R. Marsilius of The Producto Machine Co., vice presidents and directors; and Charles M. Smillie of C. M. Smillie Co., treasurer. H. Verne Leoppert of Boyd Wagner Co. was re-elected executive secretary.

New officers of the National Screw Machine Products Association are Leonard R. Schaffer of Mechanical Art Works, Inc., president, and Charles L. Kerr of Kerr-Lakeside Industries, vice president. Re-elected were Roland G. Herker of Herker Screw Products, Inc., treasurer; Orrin B. Werntz, counsel and executive vice president; and Margaret S. Ballinger, secretary.

WHY CHAMFER prior to tapping?

Why? Because clean, concentric chamfered holes speed tapping operations, increase tap life and accuracy, eliminate breakage, burring or flaking and lower both drilling, tapping and scrap costs.

Therefore, you are time, tools and dollars ahead when you drill and chamfer simultaneously with Mohawk Standard Subland drills.

How? Mohawk "Standards" are faster, more accurate—eliminate jig and fixture movements — increase tool life, reduce scrapped parts and save man hours too! Mohawk Standard Sublands outlast ordinary tools and remain accurate through regrinds—right down to the shank.

Better yet . . . All Mohawk "Standards" are *immediately* available from your local distributor's stock. Call your Mohawk man and start your savings program today!

comparison chart
Drilling and Chamfer methods prior to Tapping

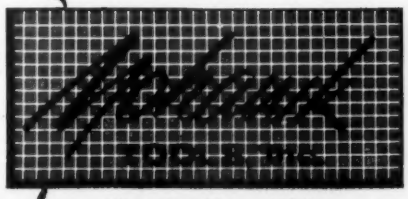
	Standard Mohawk Subland Drill	Step Drill	Separate Operations 2 Drills	Drill Operation Only No Chamfer
Chamfer Concentricity	Excellent	Excellent	Poor	Zero
Hole Location	Excellent	Good	Fair	Fair
Drill Hole Size	Excellent	Poor	Fair	Fair
Pieces Per Grind	Excellent	Fair	Excellent	Excellent
Burrs (None)	Excellent	Good	Fair	Zero
Tap Life	Excellent	Good	Fair	Poor
Regrind	Excellent	Poor	Excellent	Excellent
Local Stock	Excellent	Good	Excellent	Excellent

Remember **. . . Mohawk Standard Sublands are on your distributor's shelves—all practical standard sizes, step lengths and shanks.**

Ask For Your Copy Today!

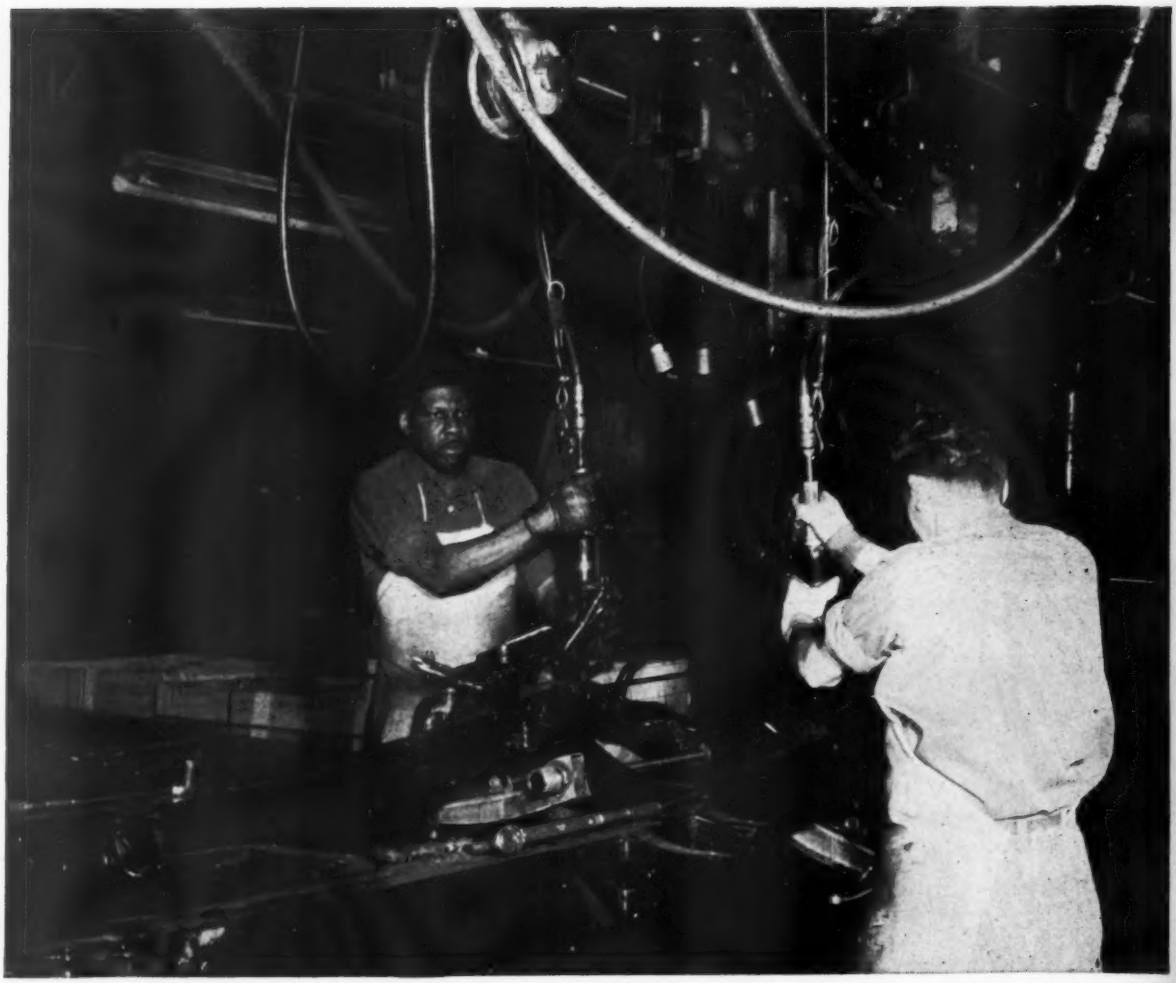
This new 12-page catalog that illustrates the multiple advantages of drilling and chamfering (prior to tapping) is yours for the asking. Lists all practical sizes, types and suggests simplified method for determining your requirements.

world's largest producer of Sublands



Montpelier, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 15



TESTING NEVER ENDS

Superior product performance is never an accident. Skilled Gardner-Denver men continually test Gardner-Denver equipment against rigid specifications to insure uniformly high quality in product after product. At Gardner-Denver *there's no substitute for men*—our 100-year philosophy of growth.

New "angles" for fast, easy, close-quarter nut running

Taking over where straight line tools must leave off, Gardner-Denver angle nut setters speed close-quarter tightening of caster-camber bolts in an auto assembly plant.

These versatile air tools easily fit in hard-to-reach places . . . do the job quickly, in a fraction of the time required by other methods. Gardner-Denver 16C series nut setters hold torque within the required 70 ft.-lb. limits . . . combine fast run-down, reserve power with low noise level and low maintenance.

Find out how Gardner-Denver angle nut setters, along with a complete line of other air tools, may solve tough tooling and production problems for you. Contact your Gardner-Denver representative or write for bulletin.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

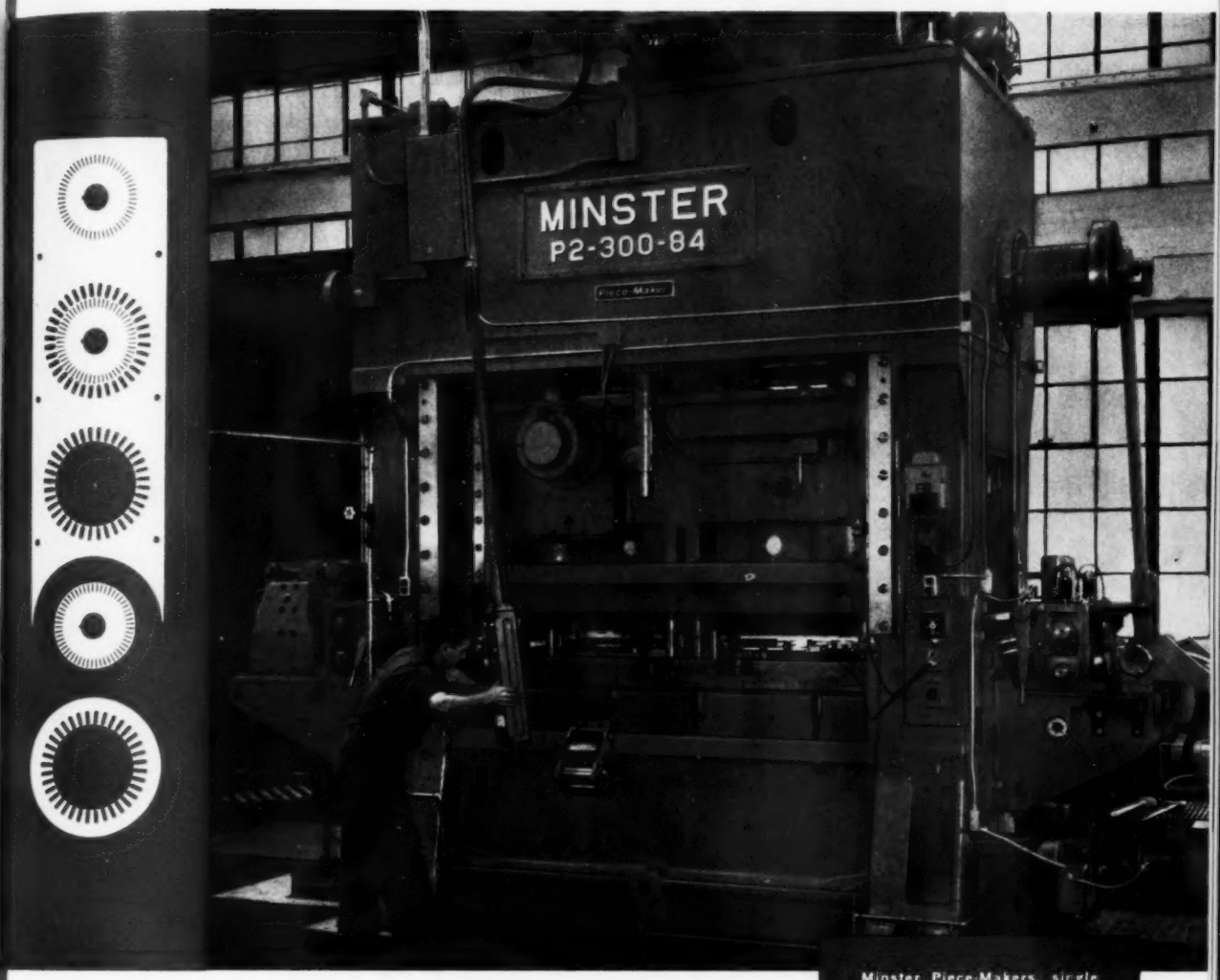
GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 16

AUTOMATIC PRODUCTION profits pay for the press



Minster Piece-Makers, single point and two point, have the precision and stability to give uninterrupted performance at the highest possible efficiency. 20 to 300 ton capacity.

Minster *Piece-Maker*® Presses

pay for themselves out of the higher profit per stamping you gain with Automatic Production.

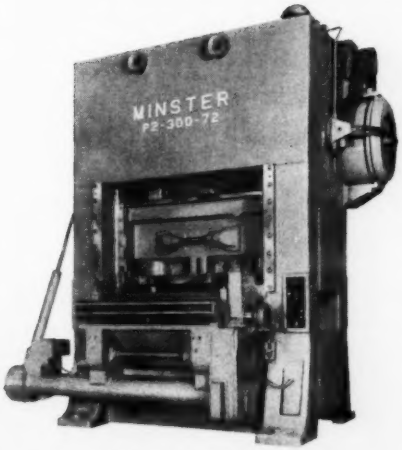
In a Minster Piece-Maker you buy more parts per hour
+ higher production capacity per sq. ft. of space
+ rapid inventory turnover + less handling and storage
+ less waste and damage + longer die and press life

= higher profits that pay for the press

Minster offers a full range of press types and sizes for automatic production. Let us show you, in detail, how a Minster press on *your* job will pay for itself. Write or call

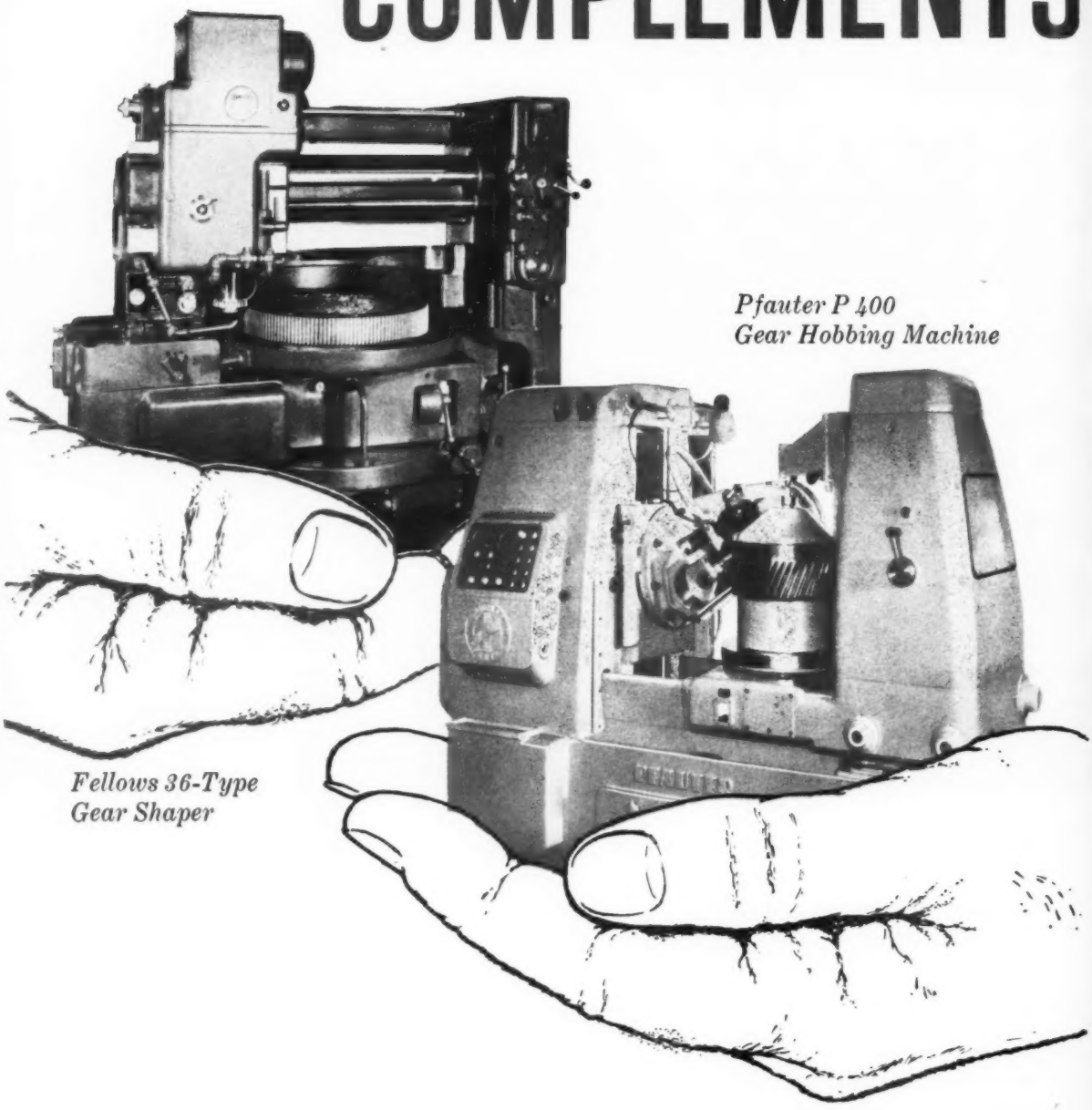
The Minster Machine Company • Minster, Ohio

MINSTER®



CIRCLE INFORM-A-GRAM KEY NO. 17

PERFECT COMPLEMENTS



Pfauter P 400
Gear Hobbing Machine

Fellows 36-Type
Gear Shaper

THE PRECISION LINE

. . . ✓ FELLOWS GEAR SHAPERS! ✓ PFAUTER GEAR HOBBERS!

Now Fellows sells, and later will manufacture, the world-famous Pfauter Gear Hobbing Machines and Worm Milling Machines.

Fellows Gear Shapers and Pfauter Gear Hobbers provide complete coverage of modern gear production equipment needs. Both operate on the molding-generating principle. The Pfauter Hobbers embody every important advance in hobbing technique, in most cases originated by Pfauter. And Fellows Gear Shapers incorporate every major advance in gear production by the Gear Shaper method originated by Fellows.

Among the many features incorporated in Pfauter Hobbers are the differential for helical gear hobbing, the hydraulic backlash eliminator for efficient climb hobbing, the fully automatic plunge for longitudinal and radial-tangential hobbing and, most recently, exclusive Pfauter DIAGONal Hobbing. Capacities of Pfauter machines range from 3″ max. P. D., 2¾″ max. face width, to 120″ max. P. D., 1¼ D. P. and 30″ max. face width.

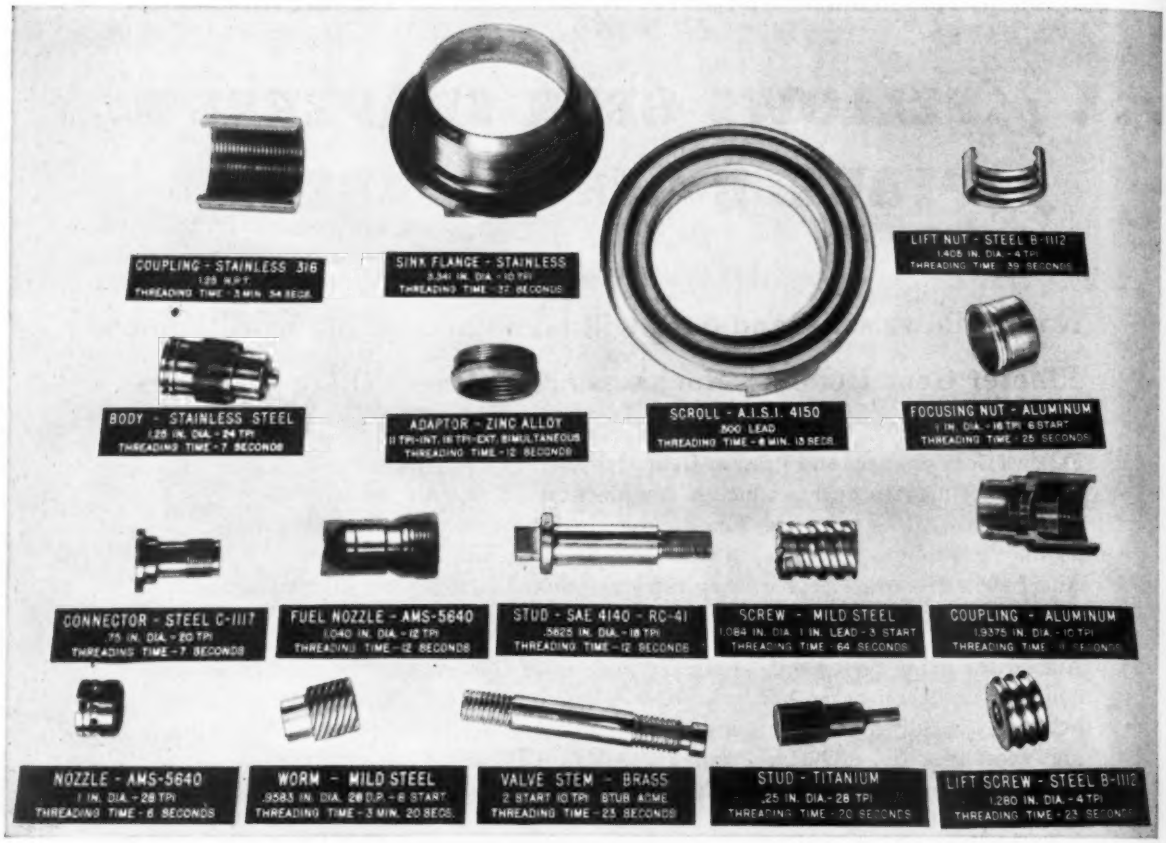
With the addition of the Pfauter line, Fellows provides the most comprehensive service possible in the field of gear production equipment. Your Fellows representative can give you full information about our machines and instruments which cover every phase of gear production.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Avenue, Royal Oak, Mich.
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

Fellows Gear Production Equipment

CIRCLE INFORM-A-GRAM KEY NO. 19

Start saving money right now on threading jobs like these with...


COUPLING - STAINLESS 316
1.25 N.P.T.
THREADING TIME - 3 MIN. 54 SECS.
SINK FLANGE - STAINLESS
3.341 IN. DIA. - 10 TPI
THREADING TIME - 27 SECONDS
LIFT NUT - STEEL B-1112
1.405 IN. DIA. - 4 TPI
THREADING TIME - 39 SECONDS
BODY - STAINLESS STEEL
1.25 IN. DIA. - 24 TPI
THREADING TIME - 7 SECONDS
ADAPTOR - ZINC ALLOY
11 TPI-INT; 18 TPI-EXT; SIMULTANEOUS
THREADING TIME - 12 SECONDS
SCROLL - A.I.S.I. 4150
.500 LEAD
THREADING TIME - 8 MIN. 13 SECS.
FOCUSING NUT - ALUMINUM
1 IN. DIA. - 16 TPI 6 START
THREADING TIME - 25 SECONDS
CONNECTOR - STEEL C-1117
.75 IN. DIA. - 20 TPI
THREADING TIME - 7 SECONDS
FUEL NOZZLE - AMS-5640
1.040 IN. DIA. - 12 TPI
THREADING TIME - 12 SECONDS
STUD - SAE 4140 - RC-41
.5825 IN. DIA. - 18 TPI
THREADING TIME - 12 SECONDS
SCREW - MILD STEEL
1.084 IN. DIA. 1 IN. LEAD - 3 START
THREADING TIME - 64 SECONDS
COUPLING - ALUMINUM
1.9375 IN. DIA. - 10 TPI
THREADING TIME - 9 SECONDS
NOZZLE - AMS-5640
1 IN. DIA. - 28 TPI
THREADING TIME - 6 SECONDS
WORM - MILD STEEL
.9583 IN. DIA. 28 D.P. - 8 START
THREADING TIME - 3 MIN. 20 SECS.
VALVE STEM - BRASS
2 START 10 TPI STUB ACME
THREADING TIME - 23 SECONDS
STUD - TITANIUM
.25 IN. DIA. - 28 TPI
THREADING TIME - 20 SECONDS
LIFT SCREW - STEEL B-1112
1.280 IN. DIA. - 4 TPI
THREADING TIME - 23 SECONDS

CRI-DAN SINGLE-POINT THREADING LATHES

...cut costs with simple single-point carbide tools. They're easily resharpened or replaced. They eliminate expensive upkeep of thread milling cutters or thread grinding wheels.

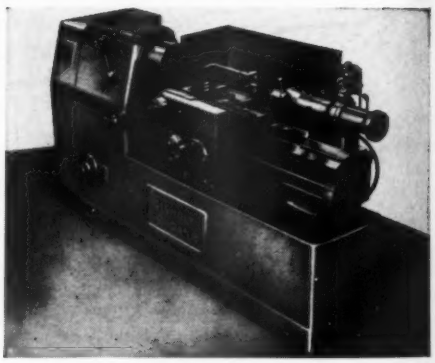
...assure extremely accurate lead and thread form and exceptional finish with low-cost carbide tools on materials that don't allow economical threading by other methods.

...handle any material from titanium or toughest alloy steels to brass and other non-ferrous metals with a wide selection of spindle speeds and feeds to meet all job requirements.

...set up fast to produce single- or multiple-start, coarse or fine, left- or right-hand threads, parallel or tapered with metric or inch pitches—thread up to shoulders on all types of internal and external operations.

...cut costs from start to finish with CRI-DAN's speed, versatility and economy.

Why put off the savings the CRI-DAN method can bring you *right now*? Ask your Gisholt Representative for complete details. Or write us for literature or cost estimates on your particular work.



Two models are available. The smaller Model B (shown) offers extreme flexibility with spindle speeds of from 154 to 2808 r.p.m.; 3' capacity between centers and 15½" swing over bed. Rugged saddle supports fast-acting threading slide, easily positioned along bed. Complete change-over from job to job can be made in 15 minutes.

Investigate Gisholt's Extended Payment and Leasing Plans

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

CIRCLE INFORM-A-GRAM KEY NO. 20

MEN YOU SHOULD KNOW

The following appointments were announced recently by Brown & Sharpe Mfg. Co.: **Charles M. Evans,** assistant general manager, Brown & Sharpe Ltd., England; **Duncan H. Doolittle,** manufacturing manager, Machine Tool Division; **A. Dean Hunter,** division superintendent, Machine Tool Division; **W. G. Leonard,** superintendent, Screw Machine Group; and **J. F. Rowley,** superintendent, Milling and Grinding Machine Group.

New officers for the Industrial Diamond Association of America include **Donald J. Wallace,** Wheel Trueing Tool Co., president; **Bernard Jolis,** U. S. Industrial Diamond Corp., first vice president; and **Leopold H. Metzger,** Super-Cut, Inc., second vice president.

Recently named administrative vice president for all operations of Sundstrand Corp. is **Louis H. Schuette. A. H. Swenson** moved up from manager to vice president of the Hydraulic Division.

The Hartford Special Machinery Co. announced recently the appointment of **Harvey L. Spaunburg, Jr.** as vice president of manufacturing, **Robert A. Bode,** vice president of sales, and **Francis A. Carr,** factory manager.

Former staff engineer **Leland E. Bruce,** has been advanced to assistant production manager of the Chemical Milling Division of the U. S. Chemical Milling Corp.

New vice president and general manager of the Claud S. Gordon Co. is **Robert H. Hoagland.**

Jan Mueller is now serving as vice president in charge of manufacturing at American Metal Products Co. **Russell G. Heyle, Jr.** was named chief engineer of research and development, and **John Hern** and **Paul Thomas** are assistant chief engineers.

... Continued on page 24

Saves 85% gaging time!

"We estimate the DR-25 saves 85% of our time in checking hundreds of cylindrical plug gages every week. We save all the time formerly consumed in gage block build-ups to check each go and no-go gage. Our checks are more consistently accurate since we no longer have to ring gage blocks together carefully and let them cool back to room temperature to keep errors from developing. The generous spindle travel of the DR-25 accommodates a great range of work without accessories. We can now check thread plug and thread setting plug gages in a third of the time formerly required to check them with gage blocks and comparators. We've found the DR-25 rapidly pays for itself in accuracy and man-hours saved."

Charles McArthur, Gage Engineer Aeroquip Corporation Jackson, Michigan

BAUSCH & LOMB
DR-25
OPTICAL GAGE

- Direct scale reading to .0001"
- 0" to 3" range without gage blocks

Find out more about cutting inspection time and costs...
MAIL COUPON TODAY

BAUSCH & LOMB

Distributed in the U.S.A. through the DoALL Co.

BAUSCH & LOMB OPTICAL CO.
77344 St. Paul St., Rochester 2, N.Y.

☐ I'd like an on-the-job demonstration of a B&L DR-25 Optical Gage. No cost, no obligation.
☐ Please send Catalog D-285.

Name, Title .....
Company .....
Address .....
City ..... Zone ..... State .....

CIRCLE INFORM-A-GRAM KEY NO. 21

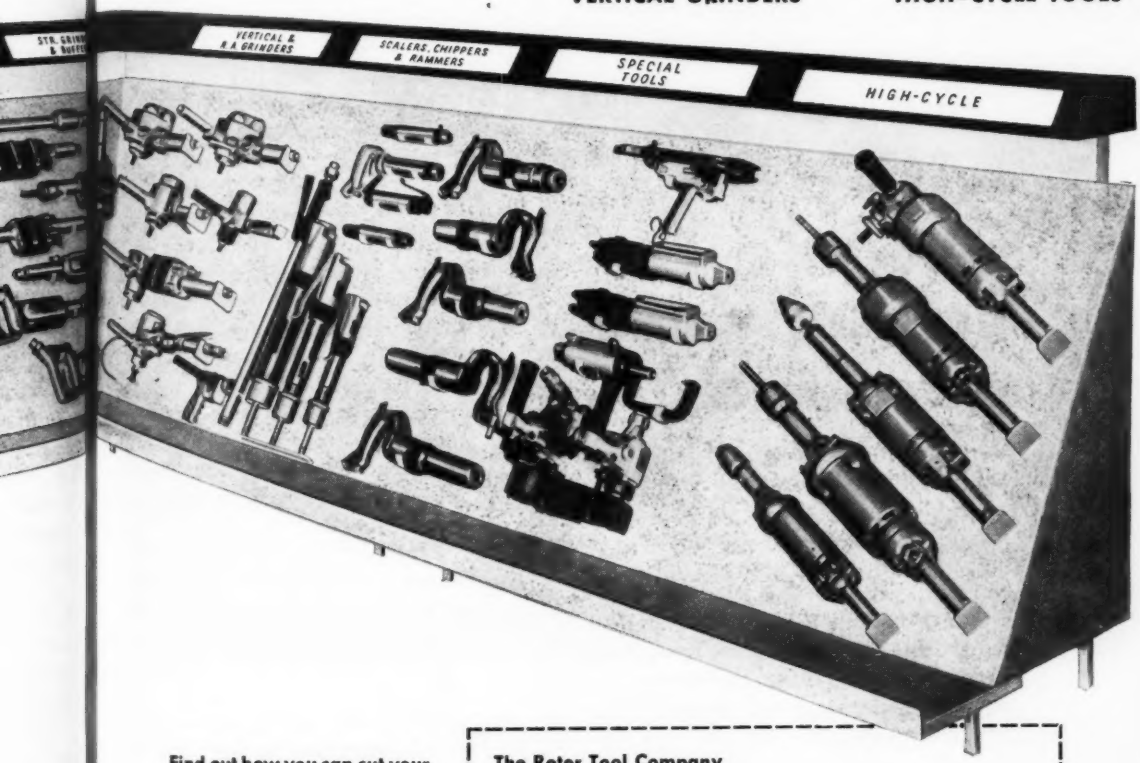
COMPARE!

(at our expense)

FOR POWER
FOR TIME SAVING
FOR LOW MAINTENANCE
FOR EASY USE

. . . THE RIGHT TOOL FOR YOUR JOB!

ASSEMBLY TOOLS
DRILLS
STRAIGHT GRINDERS
VERTICAL GRINDERS
SCALERS...CHIPPERS...RAMMERS
SMALL WHEEL GRINDERS
SPECIAL TOOLS
HIGH-CYCLE TOOLS



Find out how you can cut your costs with ROTOR TOOLS. Ask for a free demonstration. Mail the coupon today.

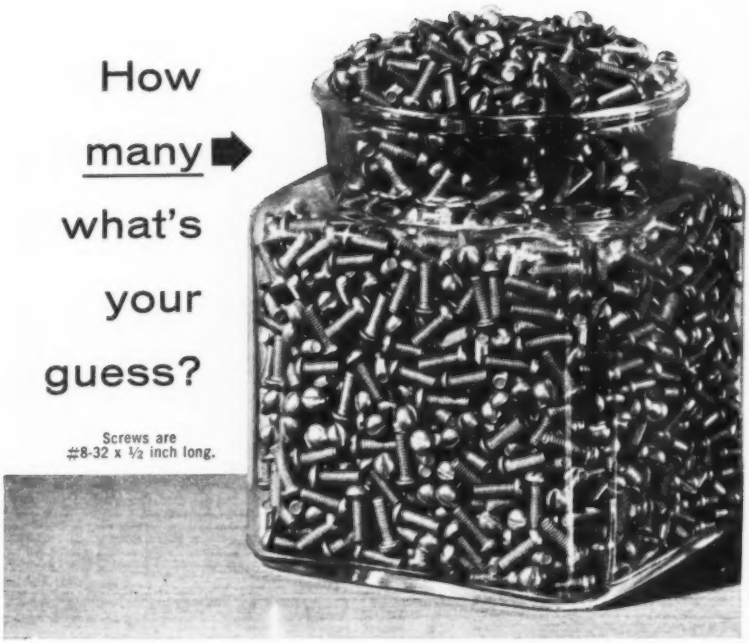
The Rotor Tool Company
26300 Lakeland Avenue
Cleveland 32, Ohio

☐ Please demonstrate Rotor_____ in our shop.
☐ Send literature for_____

Company Name_____
Company Address_____
Your Name_____
Position_____
City_____ **Zone**____ **State**_____

CIRCLE INFORM-A-GRAM KEY NO. 23

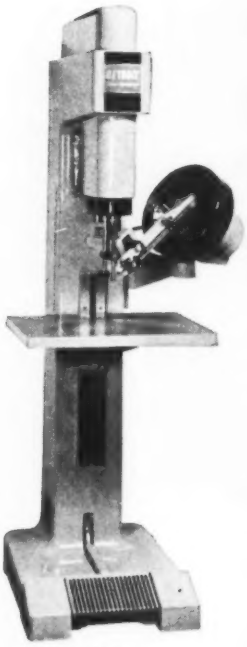
How many ➡ what's your guess?



Screws are #8-32 x ½ inch long.

One man can drive them in one hour

with a DPS power screwdriving machine



The new DPS Model U screwdriving machine.

Why sacrifice manpower on so simple yet tedious a job as driving screws? Free skilled hands for more productive work . . . get higher output per happier manhour—with a DPS power screwdriving machine.

To illustrate, one worker can drive the 2,400 screws in the jar above in one hour. And with no more effort than pressing an air-operated foot pedal. Equally important, they're driven through an easily adjustable clutch, designed to hold constant driving torques.

NEW! THE MODEL "U"—At left, meet the great, new DPS Model "U" screwdriving machine—quickly adaptable for fast, clean driving of screws, nuts and studs. New folder contains full data. Write for your copy today. 15,048

DETROIT POWER SCREWDRIVER COMPANY

2827 W. Fort St. Detroit 16, Michigan

A Subsidiary of Link-Belt Company

CIRCLE INFORM-A-GRAM KEY NO. 24

. . . Men from page 21

The Cincinnati Milling Machine Co. has elected **P. Willard Crane** vice president, and The Cincinnati Milling and Grinding Machines, Inc. has made **Richard A. Didday** vice president.

Election of **H. H. Whitmore** as executive vice president and **J. C. Hebert** as vice president was made known by Jones & Lamson Machine Co. **R. S. Jones** is the new general manager.

William F. Fischer, Jr., succeeds his father as president of the Fischer Machine Co., and its subsidiary, Scriptomatic, Inc. **Herbert W. Leonard** serves as vice president of Scriptomatic.

New general manager of the Reliance Division of Eaton Mfg. Co. is **Paul A. Miller.** He succeeds **C. A. Sellen,** who becomes head of the division's expanded steel sales program.

Recent appointment of **Andrew B. Pulliam** as president and general manager of the Marvel-Schebler Products Division of Borg-Warner was announced by the company.

Veet Industries has announced the recent appointment of **Charles Peterson** as chief engineer.

Stromberg Time Corp. recently appointed **William E. Carlson** manager of manufacturing and **Raymond Gooley** to plant superintendent, Carlson's former position.

Promotion of **Robert S. MacArthur** to president and chairman of the board has been made known by Stocker & Yale, Inc.

L. S. Hilton has been appointed manager of the Abrasive and Diamond Wheel Departments of the Manhattan Rubber Division of Raybestos-Manhattan, Inc. **C. Fleming, Jr.** was appointed production and development manager.

Ralph E. Price has been elected executive vice president and assistant general manager of Landis Tool Co. The appointment of **William P. Flohr** as chief engineer was also announced.

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Waterbury 20-A, Connecticut

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THE AMERICAN BRASS COMPANY · FABRICATED METAL GOODS DIVISION, WATERBURY 20, CONN.

COST-CUTTING IDEAS THAT PAID OFF

All the parts shown on the cover of the booklet were designed to serve a specific function—at a lower cost. Some of them are made from customer-owned tools, specially designed to make a better part at a saving in material cost and fabricating time. They illustrate only a few of the thousands of multiple-plunger and progressive-tool press products we supply to every branch of industry—from simple eyelets to precision electronic components.

We offer a complete design-engineering service based on long experience and specialized production equipment, and often are able to suggest ways and means of using some of our many stock tools to cut your costs still further.

Perhaps we can develop cost-cutting ideas for you, too. The booklet describes and illustrates the range and types of parts we fabricate. A sample, drawing or description of a part you need to produce at a low cost will give our designers a chance to work on your cost problems—at no obligation to you.

ANACONDA®

MULTIPLE-PLUNGER PRESS PRODUCTS

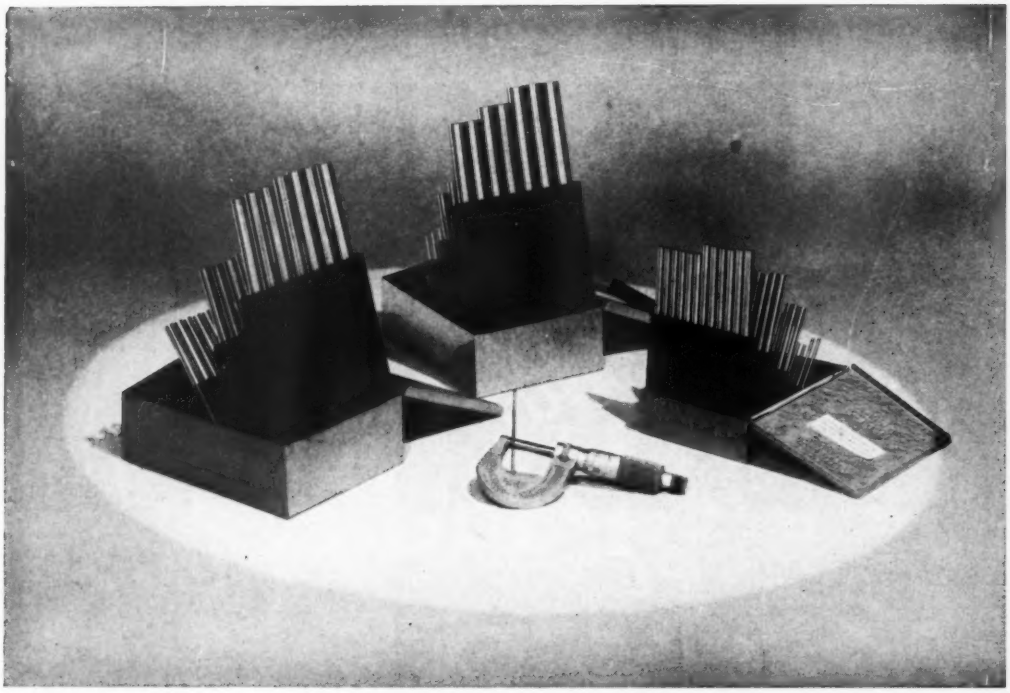
CIRCLE INFORM-A-GRAM KEY NO. 25

DRexel 6-4222 ESTABLISHED 192

WILLIAM T. HUTCHINSON CO.

53 BROWN AVENUE SPRINGFIELD, NEW JERSEY

HUTCHINSON HSS BLANKS



115 Pieces – COMPLETE – .040" to .500" – $88.00

your choice of two tolerances
+ .0002" − .0000
or
+ .0000 − .0002"

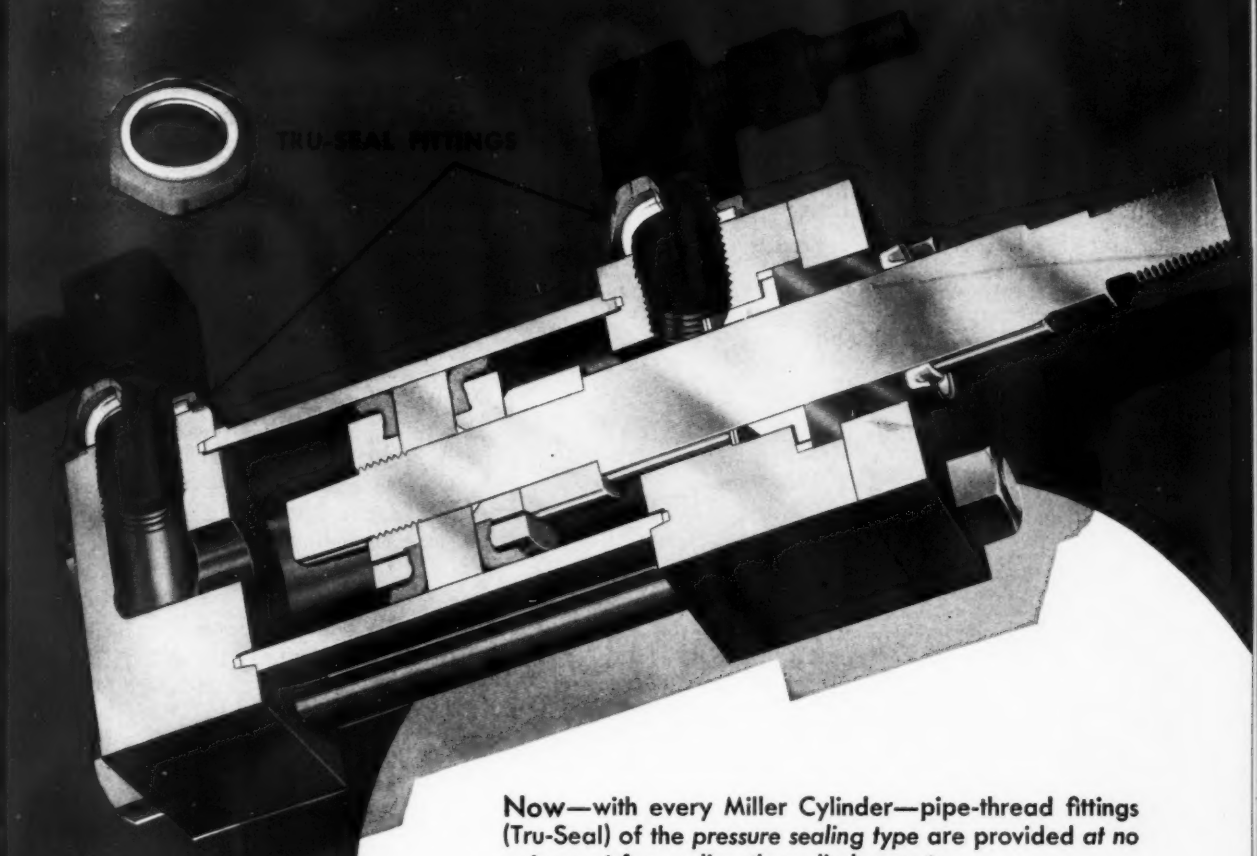
JOBBER SET	LETTER SET	WIRE SET
$32.27	$29.03	$27.40
in Huot Index	in Huot Index	in Huot Index

M2 — HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish — parallel ground.

ANY DECIMAL DIAMETER OF STANDARD LENGTH
.012" TO 1.000" SHIPPED ON 24 HOUR NOTICE

CIRCLE INFORM-A-GRAM KEY NO. 26

NOW...even the PORTS have seals of the PRESSURE SEALING TYPE!



Now—with every Miller Cylinder—pipe-thread fittings (Tru-Seal) of the *pressure sealing type* are provided *at no extra cost* for sealing the cylinder ports.

Additional advantages of these fittings are:

1. All circuit piping and fittings can be easily positioned.
2. Damage to equipment caused by high tightening torque is completely eliminated (especially on valves, pumps, etc.)
3. Sealing material is Teflon, which is compatible with all hydraulic fluids (J. I. C. Standard H6.2.1)

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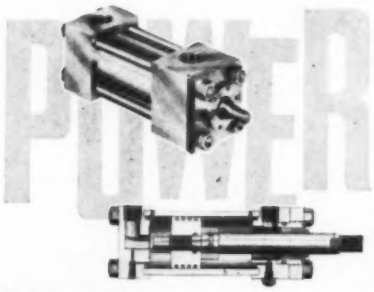
Greater Reliability

Engineering Bulletins
on Miller Air and Hydraulic Cylinders
Available on Request

MILLER FLUID POWER
DIVISION OF FLUID-ELECTRIC CORPORATION

7N028 YORK ROAD, BENSENVILLE, ILLINOIS

there's **power**
to spare in
O-M heavy-duty
Hydraulic
(oil) **Cylinders**



Series TH
2000 psi operation
3000 psi non-shock
Available in 1½" to 8" bores
Meet JIC Standards

IF you need smooth, dependable straight-line motion for heavy-duty pushing, pulling, elevating, lowering, clamping or knock-out operations, these powerful, O-M components have what it takes and more, too. To deliver this plus in power, every essential design and construction feature has been employed.

For example, these units are ruggedly constructed of heavy wall seamless steel tubing microhoned to minimize friction. The ports are large and unrestricted. They can be located at 90-degree positions. These cylinders are sealed right to prevent power loss. The piston rod is stress relieved, turned, ground and polished, high tensile steel, chrome plated. In addition, the rod gland cartridge, accurately piloted in the rod head to assure perfect alignment, is easily unscrewed and removed. Pilot O.D. of cartridge serves as pilot for cylinders mounted on rod end. A cushion ball check valve provides for rapid, full power start of return stroke.

These and many other advancements are described in our latest catalog No. 105. Write for your copy TODAY or consult your local O-M representative.

ORTMAN-MILLER MACHINE CO.
21 143rd Street, Hammond, Ind.

☐ Have representative call
☐ Send Bulletin 105

Name_____ Position_____
Company_____
Address_____
City_____ Zone___ State_____

CIRCLE INFORM-A-GRAM KEY NO. 28

MANUFACTURING MEMOS

Russian Techniques . . . Now you can get the inside dope on what Russia is doing in the technical field without taking a course in Russian. Because the Russians have done important engineering research and development work, Production Engineering Research Association of Great Britain has begun translating one of Russia's leading technical journals, **Stanki i Instrument.** The English version, **Machines and Tooling,** is available by subscription from the association, Melton Mowbray, Leicestershire, England.

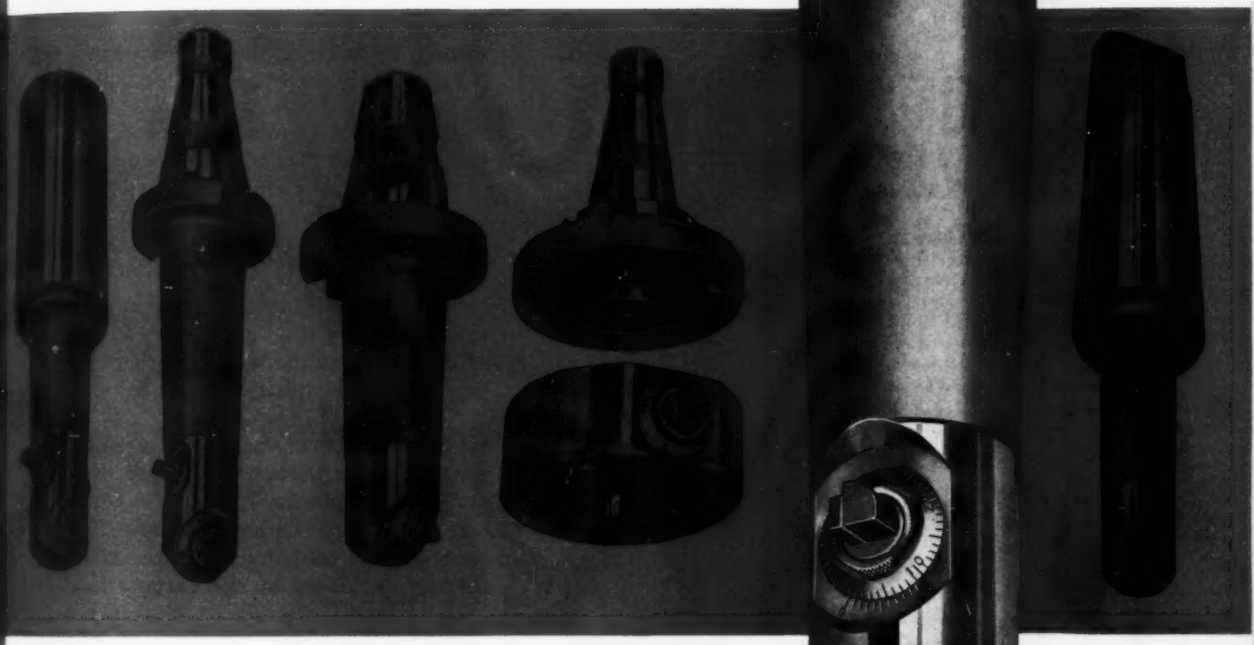
Who's Paid Overtime? . . The American Management Association recently came up with some figures that show that some companies do compensate supervisors and management personnel for overtime work, although it's not required. Fifty-two percent of 434 companies grant payment or time off for overtime work to factory and clerical first-line supervisors, salaried professionals, and middle and top management personnel. In most cases straight time is form of payment.

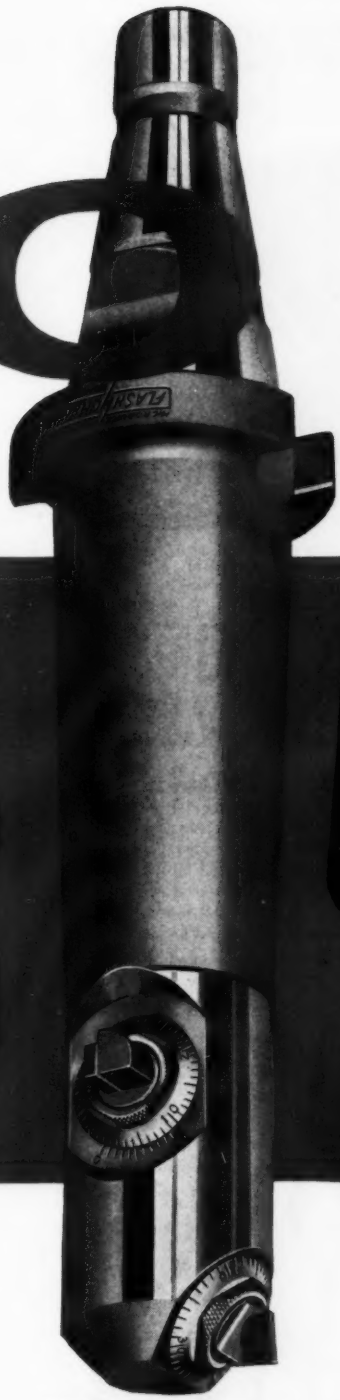
Cream of the Crop . . . A few of the top 502 best managed companies in 1958 include Cincinnati Milling Machine Co., Ex-Cell-O, Monarch Machine Tool Co., National Acme Co., United Greenfield Corp., and Warner & Swasey Co. In a comparative survey in the machine tool industry, the American Institute of Management cited these companies whose managements do the most to increase productivity and to benefit employees, shareholders, and communities.

Construction Ahead . . . A 40,000 sq ft research center is being planned by Warner & Swasey Co. in Solon, Ohio, to house offices, design and experimental areas, prototype shop, and high bay general test section.

Film Festival . . . New industrial products, devices, tools, methods, and scientific findings are shown in a new batch of films introduced in a catalog. Subjects include steel and brass making, obsolescence of machinery, modern process heating, and forging in closed dies. Either catalog or films can be had from Modern Talking Picture Service, Inc., 3 E. 54th St., New York 22.

now... over 330 standard Microbore boring bars from stock!





Your choice of over 330 Microbore standard single-tool or two-tool precision boring bars. A complete range of sizes and types available for boring and facing operations on any make of boring machine, milling machine or turret lathe. *Microbore micrometer vernier adjustment of each tool point* makes it possible to quickly set tools to *precise dimensions.* Boring range from ½" to 7¼" dia. Standard Boring Rings and Adapters extend range to 13¾". Available with Straight Shank, NMTB Taper, Morse Taper or Flash-Change. Carbide, ceramic, or high speed steel cartridges. Ordering is Simple! Fast! Direct! Standardize on Microbore—the complete tooling system.

Catalog No. 58 lists industry's most complete line of standard general purpose precision boring bars. Write for your copy.

Also available—special tooling designed from your part prints by our Proposal Engineering Department.

DEVLIEG® MICROBORE® SYSTEM

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

Fair Street, Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 29

New "Series 333" Drills for Drilling Cast Iron!

ACE

CARBIDE DRILLS

Whatever your carbide drill requirements may be . . . whether solid carbide or carbide tipped . . . it always pays to make sure you use an "ACE". Their "ground-from-the-solid", highly polished flutes have keener, stronger cutting edges. And that means finer accuracy, longer tool life, and lower drilling costs for you!

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL

ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

CIRCLE INFORM-A-GRAM KEY NO. 30

MANUFACTURING MEMOS

Service with a Smile . . Over 1,000 contract tool and die plants are listed in a 1959 Directory of Special Tooling Services by the National Tool & Die Manufacturers Association, 908 Public Square Bldg., Cleveland 13. Each member company is listed by geographic location with name, address, phone number, individuals to contact, and the specialized products and/or the services offered. You'll find 41 different categories of special tooling services, too.

Coming Events . . . **Aug. 10-13.** Society of Automotive Engineers' National West Coast Meeting, Hotel Georgia, Vancouver, B.C.

Aug. 19-20. National Screw Machine Products Assoc.'s Third Biennial Sales Conference, Wade Park Manor Hotel, Cleveland.

Representatives . . . The Cleveland Punch & Shear Works Co. has appointed Tornquist Machinery Co. of Burlingame, Calif., as their dealer in the San Francisco area. Tornquist will also represent The Hamilton Tool Co. in northern California.

Ortman-Miller Machine Co., Inc., is now represented by the John Henry Foster Co. of St. Louis and the Womack Machine Supply Co. of Houston.

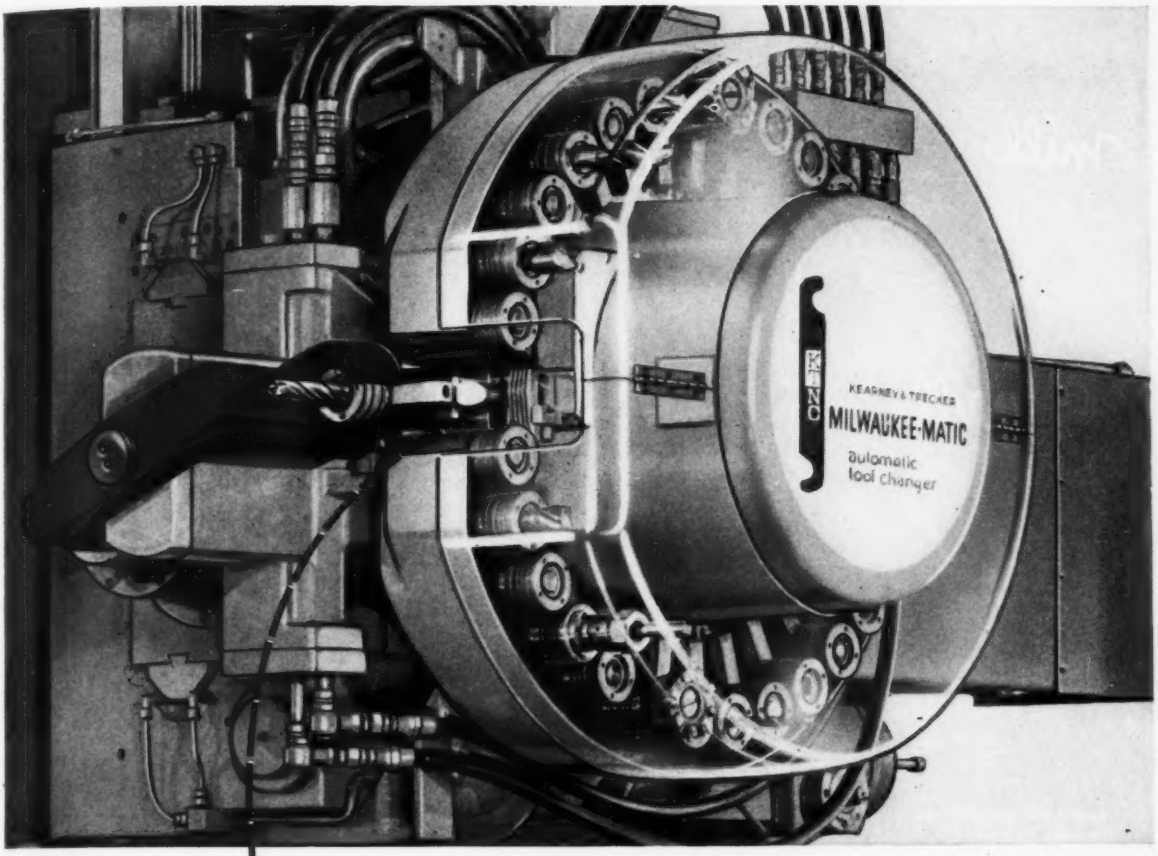
Award Winner . . . Donald C. Burnham, vice president in charge of manufacturing, was recently given Westinghouse Electric Corp.'s highest award, the Order of Merit, for his "outstanding contribution to the manufacturing operations of the corporation."

Name Changes . . . Raytheon Co. is the new name of the electronics firm formerly known as Raytheon Mfg. Co.

Davidson Mfg. Co., technical-optical manufacturer, is now known as Davidson Optronics, Inc.

Changed Hands . . . Purchase of the 493,000 sq ft Fairchild Engine Division plant at Deer Park, N. Y., by the Airborne Instruments Laboratory Division of Cutler-Hammer, Inc., has been made known.

New Company . . . Two pioneers of the chemical milling process have struck out on their own and formed Chemical Milling International Corp. in Los Angeles. Frank L. Bailey is president and sales manager, and E. Lawrence Brevik is technical director.



See it in action

RIGHT AT YOUR DESK

Write for this free "Miniature Movie" on the machine that changes production schedules from MONTHS to MINUTES.

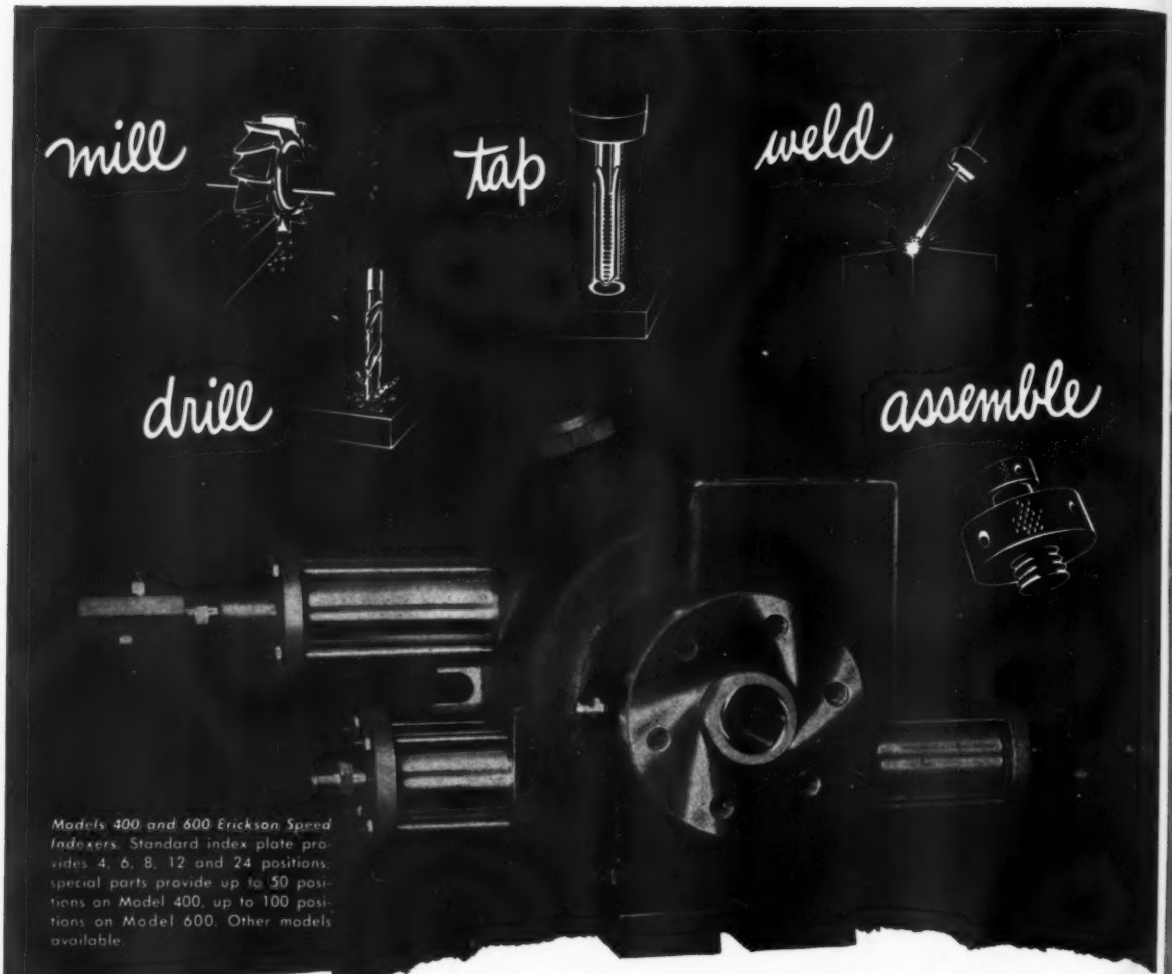
Numerical Control Division

KEARNEY & TRECKER MILWAUKEE

6776 WEST NATIONAL AVENUE
MILWAUKEE 14, WISCONSIN

(Or phone GReenfield 6-8300 . . .
Direct Distance Dialing Code No. 414)

CIRCLE INFORM-A-GRAM KEY NO. 31



Models 400 and 600 Erickson Speed Indexers. Standard index plate provides 4, 6, 8, 12 and 24 positions; special parts provide up to 50 positions on Model 400, up to 100 positions on Model 600. Other models available.

Angular accuracy within 2 minutes... repetitive accuracy in low "tenths" of a thousandth

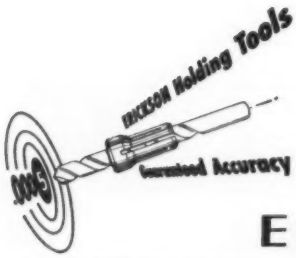
ERICKSON INDEXERS–

the economical way to smash automation bottlenecks

Even the most elaborate automatic production line can bog down *expensively* without rapid and accurate automatic parts positioning.

That's where Erickson Indexers really pay off. For you can interlock them into your production set-up with micro switches and solenoid valves. The hardened and ground lock pin operates in conjunction with the actuating mechanism to assure *positive positioning and angular accuracy within 2 minutes of a degree.* (Repetitive accuracy is no indication of angular accuracy. Erickson holds repetitive accuracy in low "tenths" of a thousandth.) And Erickson Indexers can maintain this great accuracy because their adjustable, self-contained shock control unit delivers a cushioned rotary load to the mechanism, thereby reducing wear.

Speed to keep lines moving . . . accuracy to reduce rejects . . . long life to cut maintenance and capital investment – all add up to Erickson Indexers, the *economical* way to smash automation bottlenecks.



Write for Erickson Catalog K today! **You'll find many interesting applications for all Erickson holding tools. Take advantage of our free engineering service. An Erickson field engineer will gladly work with you for production economy.**

ERICKSON TOOL COMPANY

34451-8 SOLON ROAD • SOLON, OHIO

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

AA-3107

CIRCLE INFORM-A-GRAM KEY NO. 32

YOUR COMPETITION'S NEW LOOK

YOUR CONSTANT EFFORTS to increase your plant's productivity, to modernize and/or replace equipment, to maintain high standards of quality control, constitute, all told, a pretty tough nut to crack.

If, however, you are prone to believe the evidence that's around to be believed, your job is going to get a lot tougher before it gets any easier.

Your products compete in the market place for the buyer's dollar with like products by like manufacturers — your traditional competitors.

Increasingly, however, you are facing up to competition that's far from traditional — the foreign manufacturer who is exporting his products into your market place.

You and your domestic competitors have had reasonably equitable handicaps. You are all subject to the same high and increasing costs for your materials; and you all pay ostensibly the same wage rates and fringe benefits which have given us the world's highest standard of living.

You have had to look to tooling innovations, productivity increases, scrap elimination, reduction in direct labor charges, and the hard sell for your profits.

Your profit incentives are what spark our economy, and profits come from sales — the hard sell — in the market place.

In that market place you have this new and increasing competition — foreign goods; in many cases almost as good as yours, and just as appealing to the buyer on those counts of utility, performance, eye-value and availability.

The most drastic and near-frightening difference is that your foreign competitor is underselling you to a fare-thee-well.

For his labor he is paying from one-fourth to five-eighths of what you pay. The fact that his labor force cannot enjoy the standard of living which yours demands and attains is just what enables him to offer his wares in your market place.

There can be no comfort in saying that this isn't what the British call "cricket" — the British are right in there pitching. And there's no international referee of the selling game to call "foul!"

Your customer is his own referee. The buyer of your products says, in effect, "These are my dollars, and if you want them you have to give me more for them than I can get elsewhere." It's the centuries-old language of the market place — where buyer and seller get together.

We have exported astronomical millions of dollars in foreign aid. Along with those dollars have gone American technology and know-how, to say nothing of show-how. Who ever heard of a foreign country imposing a duty or erecting a trade barrier against American know-how?

These chickens are now coming home to roost right in our own back yard.

Ostensibly, many of our millions of dollars in foreign aid have been exported with the hope of raising the standard of living in foreign countries.

The extent to which this has not worked is evidenced by the foreign competition you are meeting. Nations with equal standards of living cannot price one another out of the market place. They can only sell on merit and performance.

Art Motley, one of our leading exponents of free enterprise, once said, "Nothing happens in this country until somebody sells something." Conversely, when no one sells anything, nothing happens. What could please Mr. Kruschev more? No bloodshed — no fall out — no invasions; just no sales, and our way of life ceases to be.

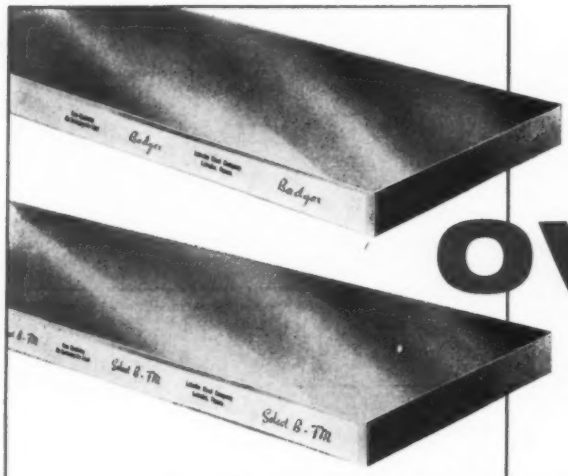
Luckily you have a priceless example of the futility of turning the other cheek to foreign competition. Detroit tried it, and what's happening?

The answer is to study and analyze the foreign products that have set up stalls in your market place — product by product, and piece by piece. Design and redesign to eliminate waste in materials and methods. Tool and retool the last ounce of direct labor out of your costs. Build-in better performance and reliability, and free yourself from re-work, service charges and complaints. And then, re-price yourself into the market.

The only way that you can do it, is to see that you have to do it!

E. Willard Pennington

Editor



Your need demanded it!

OVERSIZE

Flat Ground Die Stock

SELECT B FM A-2 Type Air Hardening

OVERSIZE: .010" to .012" on thickness

BADGER O-1 Type Oil Hardening

OVERSIZE: .014" to .016" on ¼" thickness and above
(Standard tolerances on 1 5/64" thickness and under)

Made by LATROBE

to cut your die costs!

Fully-uniform
DESEGATIZED®
SELECT B FM
(A-2 Type, Air Hardening)

•

BADGER
(O-1 Type, Oil Hardening)

Cuts die costs . . .
speeds die making!

Latrobe's OVERSIZE Flat Ground Die Stock facilitates die production by permitting design and layout to nominal dimensions—with "extra thousandths" for grinding to nominal size after heat treatment.

Latrobe's OVERSIZE Flat Ground Stock is furnished with precision-ground surfaces in 18 and 36 inch lengths. Grade is identified over entire length of bar. Over 750 sizes of O-1 type Badger and 125 sizes of A-2 type Select B FM!

Call Latrobe today—
Or, send for Bulletin P-8-9-243

LATROBE STEEL COMPANY

MAIN OFFICE and PLANT: **LATROBE, PENNSYLVANIA**

BRANCH OFFICES and WAREHOUSES: BOSTON • BUFFALO • CHICAGO • CLEVELAND • DAYTON
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When precision is expected, **you can depend on American!** American distributors offer a complete line of standard, off-the-shelf precision drill jig bushings **in your city.**

Let us send you our new catalog with drill bushing selection tables — making it easy for you to specify the proper bushings, for all your bushing needs.

American **DRILL BUSHING CO.**

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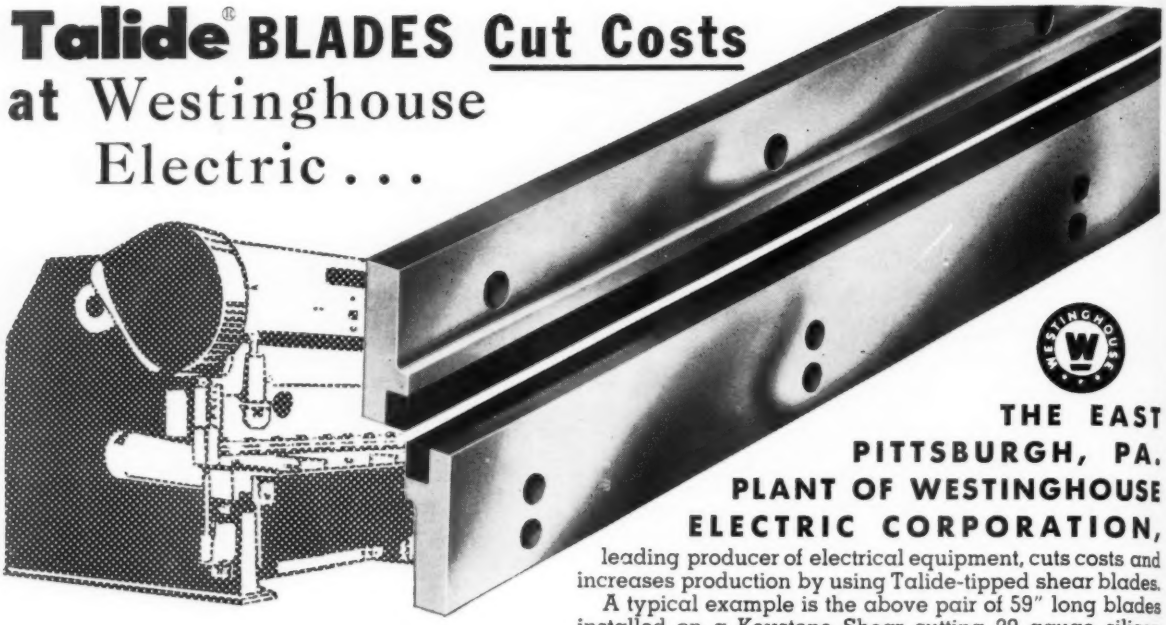
TRADE MARK ®

CIRCLE INFORM-A-GRAM KEY NO. 35

Talide® BLADES Cut Costs at Westinghouse Electric . . .



THE EAST PITTSBURGH, PA. PLANT OF WESTINGHOUSE ELECTRIC CORPORATION,

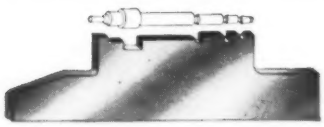
leading producer of electrical equipment, cuts costs and increases production by using Talide-tipped shear blades.

A typical example is the above pair of 59" long blades installed on a Keystone Shear cutting 29 gauge silicon steel up to 36" wide. Cutting continuously for periods up to 8 months without a regrind, approximately 5,631,000 strokes are performed at an average speed of 30 strokes per minute. 3,660 tons of metal are cut per regrind at a savings of over $2,000 alone in grinding and set-up time.

During this same period it was previously necessary to grind high-carbon, high-chrome blades 24 times — and make frequent replacement. Talide blades normally stay on the job for several years giving high-speed, continuous, burr-free production.

Talide blades are available in lengths up to 120" tipped with a **one-piece** carbide wear strip. There are no section or seam marks to score or scratch the metal being sheared or centerless ground. Users prefer blades of this superior construction.

CENTERLESS BLADES



LARGE ELECTRIC MOTOR PLANT

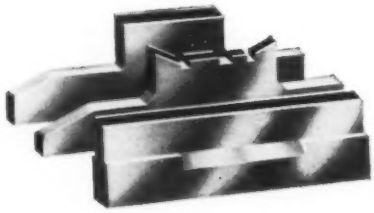
Part.....Stainless steel rotor shaft for electric motor.

Operation...Grind 7 diameters simultaneously.

Machine....No. 12 Landis Centerless Grinder.

Blade.....Special multiple step Talide-tipped work support blade No. C-4884.

Results.....Talide-tipped blade in continuous production for 91 days (2 turns per day) compared to best previous production run of 3 days with hard alloy steel blade.



Over 50 sizes and styles of standard Talide-tipped blades carried in stock for Landis, Cincinnati and Van Norman Centerless Grinders. Special blades made promptly to order.

TALIDE ROTARY KNIVES GIVE PHENOMENAL RUN OF 90-1 . . .

A leading strip steel producer of razor blade, high-carbon, spring and stainless steel reports over 1200 coils were gang slitted with Talide knives, compared to 15 coils with steel knives. More tonnage was produced in one regrind of the Talide knives than over the entire life of a set of steel knives. Burr-free, clean-cut edges produced with scrap rate practically eliminated.

EXCLUSIVE RETIPPING SERVICE

Because of its exclusive hot press method, Metal Carbides is able to rework worn, chipped-out or broken areas of carbide-tipped blades back to original size and dimension with all breaks and defects eliminated.

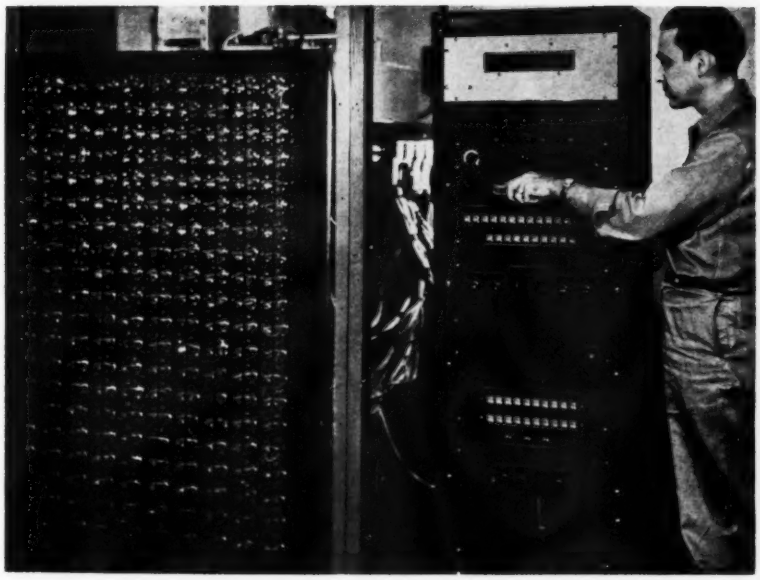
METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

Ask for a Talide Sales Engineer to call— or write for 76-page 56-G catalog.

METAL CARBIDES CORPORATION
Youngstown 12, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 36



Automatic equipment makes 1500 readings/hr and records data from specimens housed in the environmental chamber behind the control board at the left. The data is analyzed quickly by computer.

Reliability Engineering Today and Tomorrow

*by Kenneth E. Cochran**

HOW CAN WE MAKE SURE THAT autos, television sets, and other personal equipment will not require repairs so often that owners despair? How can the Armed Services have confidence that their rockets, communication systems, and atomic powered equipment will operate as desired? How can a company be certain that its products, when sold, will stand up satisfactorily under use? These are problems which a new field, reliability engineering, is well on its way to solving.

What Is Reliability?

Reliability may be broadly defined as: the probability that a device will function properly in the expected environment for the time intended.

The guarantees that many products carry are in themselves statements of the time the manufacturer believes the product will be trouble-free. In the past, knowledge of dependability was generally based upon experience and empirical evaluations of the completed product.

What we now know as reliability engineering, however, is essentially a predictive science. It is concerned with the prediction of how long equipment will last in a specific environment. It also provides the techniques for developing products with a designated life span, and for improving products to meet higher requirements. Materials, production processes, and Quality Control measures must also be considered when the proposed product reaches the manufacturing stage.

In reliability engineering much use is made of theoretical studies for determining the designs and materials best fitted for the desired product. Computers are used in such studies, enabling engineers to analyze and select the most promising designs before building any models. By such techniques, much of the preliminary activity can be speeded to completion at relatively low cost. Of course, empirical evaluation of components and systems, after prototypes have been built, still plays an important part. The final proof of a component's or system's dependability always comes in its operation and use.

In general, the various aspects of reliability work can be identified with one or more of the

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Visual examination under a microscope is still one of the best methods for determining how transistors fail.

nine general areas which make up the total concept of reliability engineering: setting reliability requirements, design analysis, development of evaluation techniques, Quality Control, quality assurance, specification engineering, environmental evaluations, failure analysis, and data analysis and presentation.

Setting Reliability Requirements

How can we measure a product's quality and assign it a required quality level? The best single measure is the answer to the question, "How long will the product last or perform properly, without repair?"

Unfortunately, as products become more complex reliability or quality requirements are increasingly difficult to assign. The degree of reliability demanded in a product depends largely upon the consequences of its failure to the user. In an automobile, a failure could mean total catastrophe, severe inconvenience, or merely a nuisance, depending upon which parts failed. Certain complex products, then, require the establishment of several levels of reliability.

To establish reliability requirements, the manufacturer must carefully analyze these factors: the possible price range of the equipment as determined by a study of the market, the uses of the equipment and the consequences of its failure, and the state of the art.

Once the reliability requirements for the complete product have been established, those for individual components may be set. With some knowledge of the environmental stresses encountered by the system during normal operation, the reliability engineer can draft realistic parts specifications to insure the maintenance of the agreed upon quality level.

Design Analysis

The ultimate key to the reliability of equipment is its design. Since little can be done to improve the reliability of an unsound design, the manufacturer's concern about design analysis should be proportional to the degree of reliability required.

In design analysis or "design optimization" the reliability engineer makes full use of his skills in component evaluation and computer technology. He is concerned with the prediction of component degradation as related to time, and the resultant effect on the operation of the entire equipment. By using component life evaluation data, he can arrange required component tolerances so as to provide the optimum functional life of the equipment. These techniques have already proved their worth in optimizing equipment maintenance schedules and in other ways. Their use has resulted in tremendous advances in equipment reliability, especially when applied to extremely complex systems.

Evaluation Techniques

Over the past several years, the numbers of samples being used in reliability determinations have grown. By developing combined environments, engineers are able to simulate actual operating conditions more closely. Development of the digital voltmeter has not only increased the accuracy of measurements, but has also made possible the automatic measurements of large sample sizes. Moreover, better experimental designs are being used which measure a wider range of parameters and thus provide more meaningful data.

One of the most significant advances is the development of accelerated tests and screening procedures. These enable the reliability engineer to predict rather quickly, on the basis of relatively brief evaluations on a number of samples, the reliability of a particular batch of components being considered for production use.

Quality Control

In Quality Control the problem is to relate measures of product quality to a particular production operation or combination of operations. Once this relationship has been established, quality slippage, as gaged by quality assurance data (see below) can be traced to a particular faulty manufacturing operation. Then the production engineering group can take measures to correct the error.

Sufficient statistical measures of quality provide two means for improving production efficiency. First, the data can be fed back through the production en-

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We are grateful to Battelle for kind permission to present our condensation of the original.—E.W.P.

gineering group to help it maintain a uniform product which adheres tightly to specified requirements. Second, the ease with which a particular specified requirement can be met is readily determined. This information has manifold implications in both production economics and product development research. For example, assume that through Quality Control procedures a particular product has stabilized at a point well above the minimum required quality level. Two advantageous actions are possible — the costs of 100% quality inspection may be reduced by turning to sampling, or quality requirements may be raised, leading to a higher quality, high-reliability, higher priced product.

If, on the other hand, the reverse condition is evident and the stabilized quality distribution falls below the minimum acceptable requirement, further research may be worthwhile, the cost of the product may be modified to justify 100% inspection and a high percentage of scrap, or the production of this item may be discontinued.

The over-all advantages of a statistical Quality Control program are as follows: Product uniformity can be kept within tight limits through information feedback; hence, scrap production may be reduced to a minimum. The program provides a sound basis for price determination. The best cost relationship of product quality, research and development activities, and production facilities can be determined more easily. Costly 100% inspection can be minimized. The product uniformity due to Quality Control techniques can eventually lead to higher degrees of component reliability, and hence, to advancement of the state of the art.

With this equipment, spotting weaknesses or failures is simplified by superimposing actual readings from a component upon simulated ideal readings.

Quality Assurance

Quality assurance techniques are necessary to implement Quality Control techniques. Inspections can aid the purchasing department by monitoring the quality of incoming parts and thus gaging the suppliers. Also, quality assurance procedures can provide constant monitoring of a plant's production efficiency and aid in price fixing and price forecasting.

Unnecessary or ineffective inspection procedures result in higher production costs which may affect sales in the competitive market. For this reason, quality assurance cannot be introduced blindly into a manufacturing system. The cost of establishing an inspection point in a process must be carefully weighed against the quality advances gained.

How can the best quality assurance procedure be developed? Cooperation between the raw materials or parts supplier and the user is a very important step. Also, thorough study and knowledge of the probable effects of material or part weaknesses on the quality of the finished product will help determine the best arrangement of inspection stations. Critical study of the inherent capabilities and weaknesses of the item produced can result in better Quality Control procedures and more realistic warranty periods.

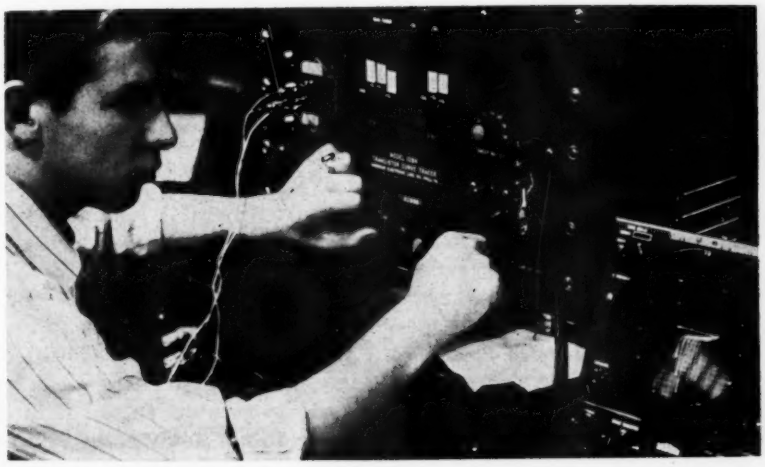
Specification Engineering

Specifications are, naturally, based primarily on experience with a product or process. In preparing them, the engineer must carefully analyze the planned use of the specifications so that their requirements are neither too stringent nor too lax. The basic types of specifications are discussed below.

Target specifications set the objectives which designers and management agree upon as the properties desired in a new product. The specifications give the designer his first rough set of goals; and those goals, with such modifications as may be made, stand until the first prototype has been built. Then the working specifications are prepared.

Working specifications cover the complete plant activity in connection with the production of a proposed product. They extend from the receipt of materials, parts, and devices, through manufacture and assembly to final inspection before shipping.

Specifications for incoming materials or parts must be drafted with a good understanding of how initially measurable performance variations are likely to influence production and the end product. A proper balance between incoming quality and end-item quality, keeping in mind the desired end-item use, is necessary to produce an item at minimum cost.



Unfortunately, such balance is not easy to hold. For example, introduction of a new material, with imperfectly understood properties, may cause major manufacturing difficulties or high customer returns because of field failures. Inspection is not enough to prevent this. New materials, parts, and sub-systems should be introduced only if their effects on the quality of the item are known.

Sales specifications for the use and limitations of products are also important. If they are too liberal, or based on invalid experiences, failures will occur in the field, with the inevitable return of goods and loss of customers. If too conservative a view is taken in setting up specifications, sales may be lost in the competitive market. As with working specifications, the sales specification must strike a balance based on a realistic rating for use of the product.

Environmental Evaluation

Environmental evaluation is necessary for reliability and product improvement and as a basis for advertising manufacturers' claims.

The question is not **whether** operating conditions should be considered, but **which** operating conditions should be considered and in what detail. All equipment, both military and commercial, is subject to degradation from environmental stress. To measure the extent of its degradation a device must be subjected to one or a combination of controlled environments.

Environmental evaluations may serve several useful purposes. To measure quantitatively the reliability of a set of identical devices under some particular environmental condition, for example; to compare the ruggedness of two or more similar, but not identical, devices for some specific application; or to gage the acceptability of a device for quality inspection or Quality Control purposes.

Most well equipped laboratories are capable of reproducing the following basic environments under controlled conditions: high and low temperatures, humidity, salt spray, acceleration, sand and dust, sunshine, vibration, shock, and nuclear radiation. Various combinations of these environments are often used simultaneously to simulate more effectively the expected operational condition.

Skillful laboratory evaluations may be of value to a manufacturer for selecting the best components for use in his equipment, showing potential weaknesses in his design, providing information for sales promotion use on how his equipment performs, and indicating where further research and development are needed to improve a product.

Environmental evaluations may also be used as a tool to check production processes or to serve as a final inspection.

Failure Analysis

We have attained what can be truly called "a frustrating level" of reliability. Despite our high level of proficiency, parts and systems still fail and we are often at a loss to explain the casualty on the basis of previously experienced life information. Thus a customer wrote:

> *This motor, one out of 30 operating in the system, was just loafing along driving 25% of its intended load and yet it failed. We had another failure just like it last month. Why?*

Obviously some new factor, some new variable had been added to those factors already taken into account in designing the equipment and deciding the safety factors.

We invariably learn to avoid mistakes by first making them and then analyzing what we did wrong. The failure of the "reliable" motor is a case in point. If the ultimate cause for unpredicted failure can be identified, intelligent design changes can be made to prevent future failure. If we do not analyze the failure cause, we fail to use valuable experience.

Failure analysis often is the only way in which stresses imposed on a component under a particular application can be correctly determined. Often inconsistencies and errors in component part manufacturing processes can be identified for correction through such analysis.

No short cut to reliability exists, but failure analysis comes the closest. The data already exist, we have only to analyze them.

Along with the advances in techniques for gaining reliability data there has been much progress in analyzing and presenting the data obtained. Many techniques are concerned with mechanics of presenting data, for example varied colors are used to get more curves on one sheet for comparison. Other techniques are concerned with advanced statistical and analytical concepts, such as linear discriminant analysis, joint parameter distributions, and modeling. However, the ultimate advances in reliability engineering will be largely dependent on the analytical and predictive techniques used.

Thoughts on the Future

Today, reliability is well on the road to general acceptance. Governmental agencies, of course, already make it a practice to ask for reliability engineering in their contracts and specifications. Many companies too, have formed management groups to work toward higher reliability goals. The realization is growing that the cost of reliability is more than balanced by savings in repair, inspection, and longer product life. Even the public is coming to recognize the desirability of reliability as a means of obtaining more dependable products and of reducing the costs of service and warranties. Therefore we can expect that reliability, under some name, is likely to be included as a key step in most production processes. end

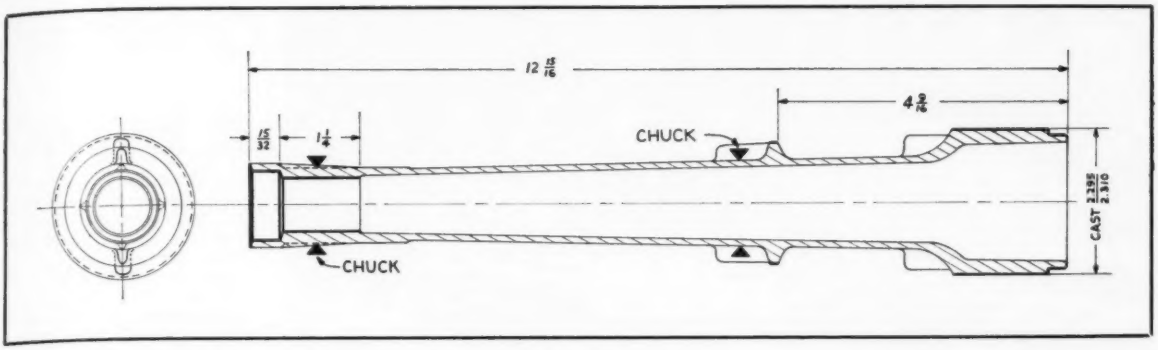


Fig. 1. Drawing of the cast aluminum agitator post for a Whirlpool washing machine. Both ends are machined, as indicated, in one setting, with the piece clamped in a special chuck.

Re-Tooling Speeds Double-End Machining

*by John Kerwin**

Both internal and external cuts, including threading, are made in a single setup with workpiece in a three-jaw aluminum chuck, rear tools being air operated.

AGITATOR POSTS FOR WHIRLPOOL HOME LAUNDRY washing machines are tapered aluminum permanent mold castings that measure about 13" long and have a maximum diameter of 2.310" as cast. A central hole is cored from end to end but only a portion of the hole at the small end requires machining; for a length of 1-23/32" and involving a step diameter. External machining is confined to the large end but involves a narrow land on the OD of a circumferential rib or flange 4-9/16" from the outer end, as Figure 1 indicates.

Posts of this general type have been machined by Whirlpool Corporation in large volume for many years and various methods and equipment have been used in an effort to keep machining costs low and still hold the rather close dimensional limits specified. Until recently, the job was done on a No. 5 Warner & Swasey turret lathe provided with special tooling so that machining could be completed on both ends in a single setting in a single chuck.

Why the Change?

This setup worked well but involved moving the tool for internal cuts on the small end by a lever that controlled a shaft running through the hollow spindle. Now, at the Clyde Division of the Whirlpool Corp., the setup has been altered and the job transferred to a 16" No. 3 Electro-Cycle Warner & Swasey turret lathe, Figure 2, that does the machining about 20% faster. This, in part, is because the tools that finish the small end, formerly moved by hand, now are air operated at a favorable and controlled rate.

As Figure 3 indicates, the workpiece is centered in a long three-jaw chuck with the large end out, facing the turret. The long jaws grip on two cylindrical surfaces between longitudinal ribs, one close to the inner end and the other back of the circumferential flange that positions the piece endwise. Loading and unloading are done by hand, using a lever that closes and opens the chuck, the remainder of the cycle being fully automatic. About half the length of the piece is inside the chuck jaws, but there is adequate space between the jaws for chips, produced by the tools at the small end, to be thrown out.

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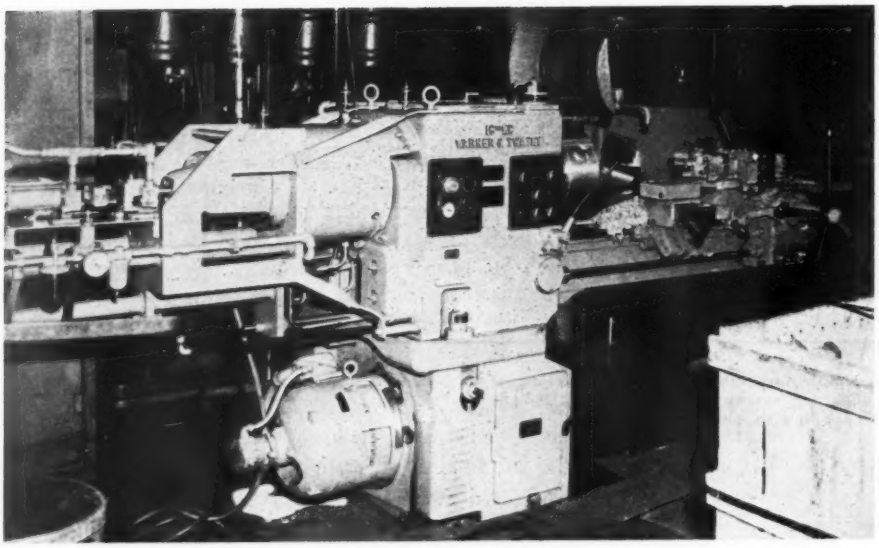

Fig. 2. General view of the new Warner & Swasey Electro-Cycle turret lathe used to machine agitator post castings. An extension at the rear end, left, includes an air cylinder for advance and withdrawal of tools on a shaft through the hollow lathe spindle.

How It Does It

Upon starting the cycle after loading, a combination counterbore and ream tool is fed in axially at a controlled rate by an air cylinder actuating a shaft through the hollow spindle. As this tool feeds to depth, a spot facer, back of the other tools, faces the small end to length. Thereupon, these tools are retracted.

Turret tools then feed in and turn the long diameter (to be threaded subsequently) and the adjacent step. A straddle tool then faces the large end. During these cuts, a cross slide tool turns the OD of the circumferential rib or flange. When these cuts are finished, and the tools are retracted, the spindle speed is reduced quickly, the turret indexes and a Landis contracting die head, equipped with carbide chasers, is fed in by the turret to produce a 2¼" - 12 thread on the long diameter previously turned.

Upon completing the thread, the die head expands and backs off and the chuck comes to rest for unloading and reloading. During all cuts except threading, the spindle speed is 1,000 rpm. To reduce the inertia of the large chuck, and the power required to bring it up to speed, as well as to reduce the power consumed in braking, the chuck and its jaws are made largely from aluminum, but with hardened steel inserts where needed to resist wear.

Precisely set limit switches start actuation of the air valves controlling motions of the ram that advances and retracts the shaft through the hollow spindle, holding the tools that make cuts inside the chuck. One of these switches determines the depth to which these tools cut, causing them to be retracted when they have been fed to proper depth.

Output of this machine is about 145 pieces/hr or approximately 20% more than for the prior setup, which was not a slow one. It is, of course, a decided advantage to have the cuts made on both ends of the agitator post without having to reset it and perform two sets of cuts having a relocating operation between them. end

Fig. 3. Closeup of the three-jaw aluminum chuck and of turret tools used to machine agitator posts in a fast cycle that is automatic save for loading and unloading.

Better Communications Speed Boeing's Tool Traffic

*by Fred L. Barcus**

MANY LARGE COMPANIES REALIZE THAT MONEY IS WASTED when lines of communication are clogged, indirect and/or inefficient. The idea is to get the word (whatever it may be) to where it counts fast, so that whatever action is called for may be initiated without delay. It is only by pinpointing specific communications needs that real and concrete savings can be realized.

This is the story of how Boeing has expedited the flow of small, expendable tools in a warehouse six miles from the using plant, through better communications. We have actually reduced, by more than half, the time it takes to move tools to the plant; have improved service from toolrooms to the shops; and have been able to reduce the amount of money Boeing must tie up in perishable tools at any one time. Moreover, we have reduced the amount of factory space needed by toolrooms and have reduced the amount of money it takes to accomplish the same tool ordering function.

Savings and Costs

Some of the above savings come into proper focus only when one realizes the vastness of our operation. There are some 50 to 60 toolrooms involved, for instance, which must supply the vast number of small tools necessary to build airplanes. Until establishment of our new system, every one of these toolrooms was "splitting at the seams" and requesting more space—a precious item in almost any manufacturing plant.

Considering that our stockroom — in the warehouse away from the plant — carries 15,000 different items in ample quantity to represent a substantial investment, it is obvious that any reduction, no matter how small percentage-wise, can release a considerable amount of money.

While the movement of tools to the job in the average manufacturing plant is not likely to equal the volume of that at Boeing, our system might well prove of proportionate value in much smaller manufacturing facilities. The annual operating costs of our kingsize system are well under $2500!

Most of this money is invested in leased telephone wires and for rental of "Electronic Longhand" devices manufactured by the TelAutograph Corporation of Los Angeles. Involved is a system of transceivers, which are instruments to send and receive messages electronically; and receivers, which receive messages.

Simplicity of Operation

These instruments require little factory space, and no operator training. It is this simple: A clerk simply uses a stylus and writes out a message on an electronic plate. The message is reproduced on paper which feeds automatically through the machine not only at the point of

Fig. 1. From four Boeing toolrooms orders for tools go to the company tool stockroom and grinding station via a system of TelAutograph transmitter-receivers — "electronic longhand." All told, fifty toolrooms channel their orders through the four transceiver stations.

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Fig. 2. The tool order is reproduced at point of writing as well as at one or more receiving stations. Duplication of the written order provides verification (who, what, and when) at point of origin, and is an assist to Boeing's tool inventory control.

writing, but at any one or several receivers located elsewhere. The operator has only to flip a key to select the points he wishes to receive his message.

Around this equipment and this idea for instantaneous transmittal of brief written messages, then, we designed a system. Involved is a small 5" x 3" "toolroom requisition" form which feeds continuously through the transceivers and receivers.

We set the equipment up for maximum service at minimum cost by selecting key toolrooms, readily accessible to other toolrooms in the same general manufacturing area, for placement of the transceiver instruments.

As a result, all of our 50 to 60 toolrooms are served by only four transceivers. A clerk in a key toolroom orders for his own and for others in the same general vicinity. This way there is no time lost by people standing around waiting to use the machine. We have three receivers, one in a major drill grinding section (from which newly sharpened bits, drills, etc. are ordered) and two in our stockroom six miles away.

These seven basic instruments have, to date, proved adequate to handle our volume of some 500 requisitions daily to the warehouse and 100 daily orders to the tool grinding station. Should it ever become overloaded, we could handle the increased volume without any major change in the basic system simply by adding an additional transceiver and/or receiver at nominal cost.

The System Works Like This:

When a toolroom's stock of any particular item reaches a pre-established reorder point, the clerk fills out an order for that item on the TelAutograph transceiver nearest him. The form utilized on the transceiver has spaces for date, toolroom number (which serves as the address), the requisition number, quantity, item, for whom needed, and the sender's signature.

The copy produced by the transceiver is kept by the toolroom initiating the requisition as a record copy. If the order is to the grinding station, it is torn from the receiver in that section and the order is filled immediately. The requisition itself is stapled to the container for the ordered supplies and the order is shipped by plant shuttle back to the requesting toolroom.

If the order is to be filled at the warehouse, the procedure is a bit different. Since the warehouse is equipped with two receivers, it receives a duplicate copy of the requisition.

The first step involved is that of tearing the requisitions from the machines by a clerk. She stamps the time received on back of each order, then sends one of the two copies of the order out to stock clerks to be filled. When it is filled, this copy of the requisition is placed inside the paper bag, box, or whatever container is used, with the ordered tools. The toolroom number is written on the outside of the container and orders are collected in a box skid for shipment back to the factory.

The second copy of the requisition is then sent to the company's purchasing section where it is used as a source document for automatic posting to inventory records which are kept on a National Cash Register 3100 accounting machine.

In the event the item ordered cannot be dispatched, the stockroom holds the requisition and sends back a simple mimeographed form which advises the orderer that the item is not being filled for one of several rea-

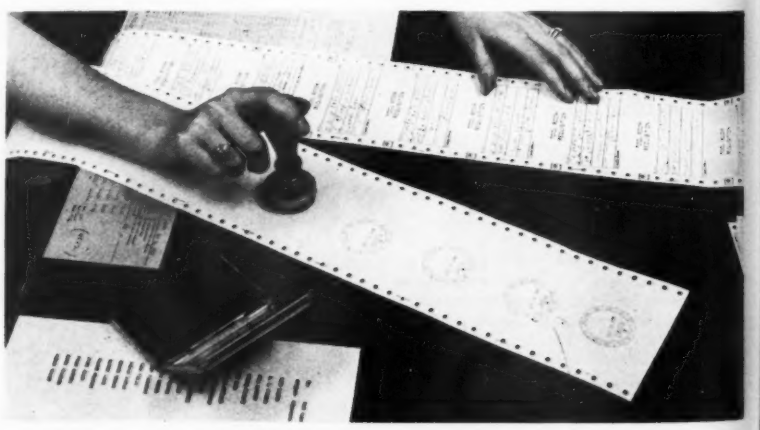


Fig. 3. Here, toolroom requisitions received in perishable tool reserve stores (tool stockroom) via TelAutograph system are time-stamped and immediately sent out to be filled by stock clerks.

Fig. 4. After an order is filled, clerk loads tools into box skid for fast delivery to toolrooms. Bags are marked with toolroom number, and contain original TelAutograph tool requisition. Order was written and received only minutes before.

sons, which include incomplete description, ordered by an unauthorized person, presently out of stock, insufficient address, or non-stock item. In cases where the item is not presently in stock but is due at a later date, this information is written in and the order is filled when the stock arrives. No repeat requisitioning is required.

Quick Delivery

Deliveries of items ordered that are in stock are made to the ordering toolrooms within 12 hours after the writing of the requisition. This is from 12 to 20 hours faster than tools ever arrived after the processing of a requisition with our previous system.

The old system involved writing a three-part requisition form in the toolroom, then sending two copies by messenger (or plant mail) to the warehouse. The undue time lag had these effects:

(1) Toolrooms felt it necessary to keep larger stock of frequently used items and this required more space.

(2) The stockroom, in turn, had to stock larger stores of these items at considerable cost in money and space. And,

(3) Tools which were ordered for immediate use in the shops were so often tardy in arrival that valuable manhours were lost in the shops. A tool setup that required many hours, for instance, might now be preserved without loss of time where the time involved under the previous system would have prohibited preservation or, at best, cost machine time where the setup was assembled.

Money-wise, we found that our TelAutograph forms cost $390 less a year than we paid for the old requisitions.

Conservatively, we saved some 780 hrs used for messenger service. And we figure that we saved at least three hrs/day, or 780 hrs/yr, in time utilized by stockroom personnel to sort requests and arrange to fill.

Traffic Peak Eliminated

Our new system completely eliminated the practice of telephoning "urgent" orders to the stockroom. Previously, in peak periods it sometimes required the full time of two people to do nothing but receive and write telephoned orders; we estimate that on the average our telephone traffic cost two hrs/day or 520 hrs/yr.

The over-all savings, we believe, are tangible evidence that the trend toward better communications is well founded. This system, in its first year, has served us so well that an identical system is being installed at Boeing's Transport Division at Renton, Washington, as well.

And all that was involved was isolating the communications problem, then finding a workable solution. end

Fig. 5. Posting machine operator feeds information from TelAutograph toolroom requisitions into electric accounting machine to establish current inventory.

Automatic Equipment Brazes and Tests Seven Joints

SEVEN JOINTS IN AN AUTOMATIC TRANSMISSION cover are assembled, brazed, and tested by a single operator in less than 4 min, thanks to specially designed and located equipment. The assembly consists of a 12″ dia drawn steel cover, having six ⅜″ dia studs and a 1¾″ tubular hub projecting through the bottom. For speed, simplicity, and strength, these seven parts are silver brazed to the cover in one operation in a seven-coil induction brazing machine.

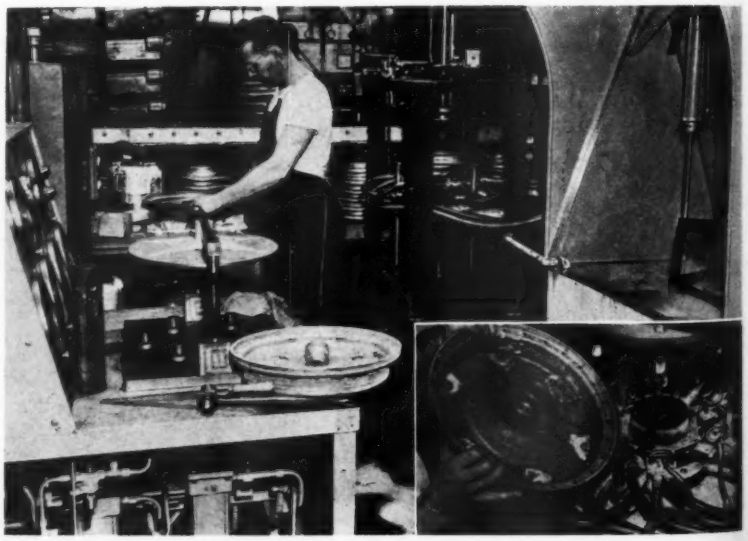
The operator assembles the parts with the cover cradled in a fixture consisting of four blocks which raise the cover off the work surface to provide clearance for the projecting studs and hub. Before insertion the studs, hub, and the areas surrounding the holes in the cover are given a protective coat of Handy Flux, applied by brush from a warmed flux pot. Prewarming makes the flux active at a lower work temperature, thus giving the parts maximum protection against oxidation as they are heated to brazing temperature.

During the assembly operation, a 0.062″ gage ring of Easy Flo 45 silver brazing alloy is preplaced like a spacer between the inside surface of the cover and each part. Diametrical clearance between the parts holes is 0.005″.

The assembly is brazed in a 50-kw induction heating machine. The cover is heated from the underside so that the molten silver alloy will be drawn down from the upper surface and braze the joint completely from top to bottom. Irrespective of gravity, silver filler metals flow toward the area of highest temperature, which makes it possible to "direct" the flow into a joint by proper positioning of the heat source.

The holding fixture consists of four T-shaped posts which support the rim of the cover and which position the cover so that the six studs and the hub are centered in their individual induction coils. Since the studs are located near the sidewall of the cover, the heating coils are shaped to an approximate right angle to heat both the side and bottom area around each stud.

The six studs and hub are held in position by the top section of the brazing fixture, which consists of seven spring-loaded plungers mounted on a common base plate that is raised and lowered by a pneumatic cylinder. The plungers keep the parts from shifting during the brazing cycle and provide the follow-up pressure that seats them against the cover when the brazing alloy ring melts and flows. The 25-sec brazing cycle is automatically initiated when the cylinder-operated section is lowered onto



View of the area where the transmission covers are assembled, brazed, and tested. Operator is assembling covers at the far end of the table, the induction brazing machine is just behind him, the wash tank at right foreground, and the test section at left foreground. Closeup of cover assembly shows the fluxed hub and six studs inserted in the cover. Mounting posts which support the cover, induction coils and air jets, and spring-loaded hold-down plungers are visible in the brazing machine.

the cover. At the end of the cycle the current shuts off, and the assembly is cooled for 35 sec by air jets centered in each of the coils.

At the end of the cycle the brazed cover is transferred to a dip tank beside the brazing unit to wash off flux residue. Putting the two operations side by side enables the same operator to handle both steps conveniently and decreases soaking time since the flux is more soluble while warm.

Because the automatic transmissions operate in a fluid medium, they must be absolutely leak-tight. To check for joint soundness, the cover is placed in a test fixture with the six projecting studs inserted into sockets mounted on the base plate. Each one contains an O-ring that forms an air-tight seal around each stud. After pneumatically lowering a circular holding plate onto the top of the cover, each joint is subjected to 80 psi. An imperfect joint can be spotted by a pressure drop. Any leakers are set aside and re-brazed with a hand torch. Later in production every joint is also shear-tested for mechanical strength with a torque wrench at a 45-lb loading.

With this automatic equipment, conveniently laid out in a compact work area, one man can handle the entire assembling, brazing, and testing operation. At a work rate of about one cover assembly every 4 min, he can produce 85 high-strength silver brazed joins an hour with a very low reject rate. end

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The patentee should investigate his rights to make, use, and sell his invention.

Problems in Exploiting Inventions

*by Walter C. Middleton**

THE GRANTING OF A PATENT covering an invention is not a key for automatically unlocking the door to exploitation of the invention. If the patentee cannot commercialize the invention himself, he may await approaches by others who may become aware of the patent, or he may try to interest others, such as manufacturers, in commercializing it.

The experiences of inventors in following the latter plan may explain why many patents never become used by anyone and the patentees gain no reward for their efforts. Many reasons have been given for rejecting patents so offered, of which the following are representative examples.

Typical Problem

Assuming that the invention covered by the patent relates to an article of manufacture, such new articles must possess several qualities, such as utility, ease of manufacture, attractive price, and the like, to gain success. If the article is so complicated that it does not lend itself to volume production, then its chances of success are materially reduced. In addition, if extremely close tolerances and the like are required for the manufacture of the article, again its chances are reduced. Complexity adds to the cost of manufacture, which can be a deciding factor since high manufacturing costs can compel such high selling prices that the article cannot meet competition.

Even though the invention may be sound theoretically, often it will be found that in the form presented by the inventor it will not perform the function for which it was intended. Often this is due to lack of thorough knowledge of the field by the inventor before he approached the problem which he was endeavoring to solve. In addition, tests may prove that the article when put into actual service cannot perform in the manner in which it was intended to perform and, therefore, does not solve any problems.

Investigation may prove that the potential market for a supposedly new article of manufacture is so small as not to warrant the cost of tooling for production and other necessary expenses for placing the article on the market. Some inventors have investigated the potential market for an arti-

*Patent Section, Central Office Staff, General Motors Corporation, Detroit, Michigan

cle before going to the expense of patenting the same, so that these considerable expenses have been saved and the article forgotten by the inventor.

If the patentee is in a position to commercialize his inventions himself, he will be well advised to have a patent investigation made by his patent attorney for the purpose of determining whether the way is clear for such commercialization. This investigation entails the study of unexpired patents in the same field and in fact is determinative of the right of the inventor to manufacture, use, or sell his invention. Patentees often are confused on this point since many believe that the grant of the patent automatically authorizes the patentee to make, use, and sell his invention. This has been true particularly prior to 1953, since patents granted before that date included in the original patent delivered to the patentee the grant of the exclusive right to make, use, and sell the invention. Having such grant in his possession the patentee can be faced by the seeming paradox of having the exclusive right to make, use, and sell his invention, but being unable to do so without subjecting himself to possible suit for patent infringement.

The seeming paradox can be clarified by the following illustration. Reverting to bygone days, assume that someone of inventive mind felt the need for some article which would serve as a support in elevated position above the floor. This individual invented a table for which a patent was obtained. One of the claims of the patent—and patent claims measure the scope of the invention—might read as follows:

"As a new article of manufacture, a table comprising a member providing a generally plane surface, and a plurality of legs depending from said member for supporting said member in spaced relation to a supporting structure." The table, being new, met with instant success, and the inventor automatically acquired to himself a ready market.

Having observed the utility of the table, another inventor conceived the idea of providing it with a movable tray, or drawer, in which various articles could be placed for concealment beneath the surface of the table but which would be readily accessible by moving the drawer outwardly from its position beneath the table. The support of this drawer could be slideways, by pivotable connection, or by any other suitable arrangement. The second inventor, therefore, attempted to obtain a patent for his invention, and, since the new arrangement presented novelty, his efforts were rewarded by the grant of a patent. This second patent may have as one of its claims the following:

"As a new article of manufacture, a table comprising a member providing a generally plane surface, a plurality of legs depending from said member for supporting said member in spaced relation to a supporting structure, and a drawer secured to the undersurface of said member in such fashion as to be movable completely beneath said member and movable outwardly relative to said member for rendering the contents of said drawer accessible."

From: General Motors Engineering Journal. Permission to reprint is gratefully acknowledged. —E.W.P.

Infringement Investigated

Analyzing the two claims from the two patents, it is seen that the second inventor could not manufacture his improved table having a drawer under it without making a table meeting the description set forth in the claim of the first patentee. Furthermore, the first patentee cannot manufacture the new table with the drawer without infringing the claim of the second patent. The second patentee could exclude everyone else from manufacturing his improved table but still was not free to manufacture it himself until the first patent expired. In this situation a license from the first patentee would permit the second patentee to make the new table, or cross licenses between the patentees would make it possible for each to make the improved article.

The courts in passing on patents have construed the provision of the statute which formerly granted to the patentee the exclusive right to make, use, and sell his invention, as actually conferring upon him the right to exclude others from making, using or selling the invention. This construction by the courts has now been incorporated in the patent statutes so patents now clearly state that the inventor is granted only the right to exclude others from making, using, or selling the invention. end

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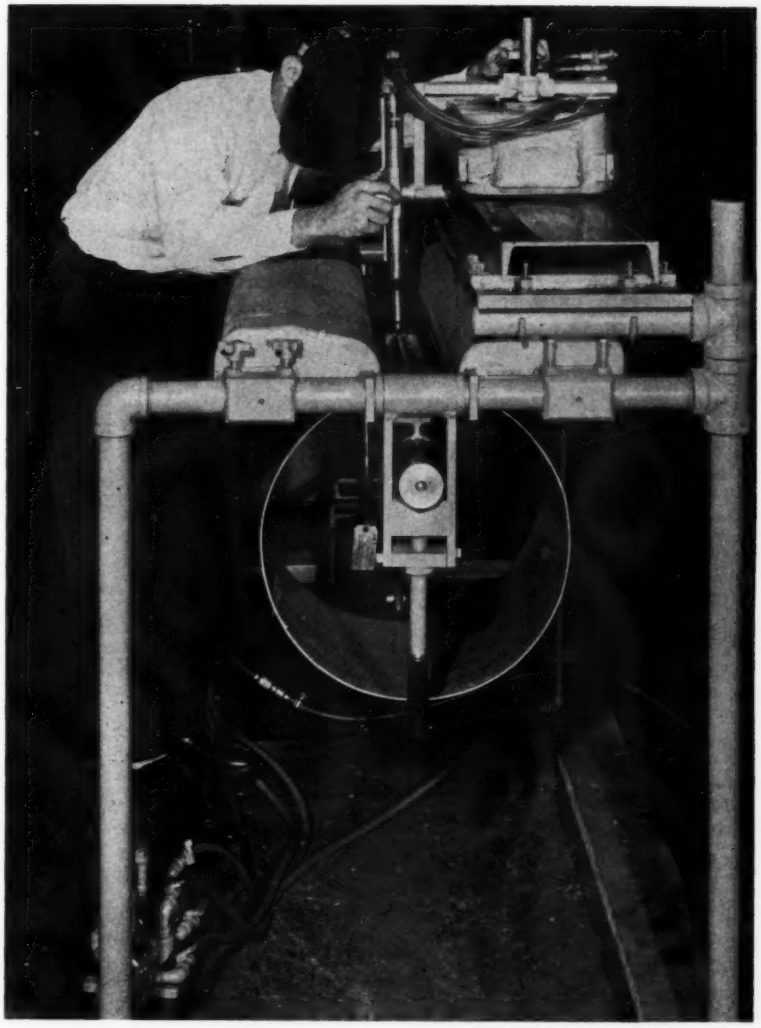


A Solution to Tight Welding Specs

A REQUIREMENT OF TODAY'S TECHNOLOGY, greater numbers of precision welded parts, is being met by welding equipment manufacturers. However, their precision machines have not always been available to small industry because of complexity and/or cost. To correct this, Airline Welding & Engineering of Los Angeles, Calif., has developed this positioner-welder and a unique sales plan.

The machine is a semi-automatic longitudinal welder that can be mounted on the floor, on the wall, or from above. Other versatility allows loading from the side or the end, depending on shape and size of the workpiece. Configurations like cylinders, cones, truncates, and those having square corners can be welded. Metals may be ferrous, aluminum alloys, magnesium alloys, or "exotics" like titanium, zirconium, or molybdenum. Welds are free from imperfections, we are told, and have "water white" seams when x-rayed.

Metal thickness is no problem, the machine can weld any thickness between 0.005″ and 0.500″ in plate, sheet, or foil with chill-shunt cooling provided by workpiece clamps and mandrels to prevent burning. Also distortion and warp are held to a minimum.

Provided a precision shear is used to prepare workpieces, they may be located in the machine within 0.001″ of true location. After locating, welds up to 78″ can be made with either a TIG (tungsten-inert-gas) head or a MIG (metal-inert-gas) head. Heads are fitted to a precision carriage, and are capable of speeds of from 5 to 160 ipm with a total vertical tolerance of 0.006″ and a lateral tolerance as close as 0.003″.

Mandrels can be interchangeable, or when different workpieces are to be handled the machine may use one mandrel designed to be rotated to accommodate all work. All mandrel work faces are fitted with copper, steel, or stainless backup bars having a "drop-thru" groove to control bead size and contour. If inert gas is used, the mandrel is furnished with a gas reservoir having regularly spaced openings for purging.

Immediately above the mandrel, two parallel banks of level-seeking (segmented) copper-tipped "fingers" grip the workpiece. Each bank is separately activated by compressed air through a foot valve, and can exert variable pressures between 0 and 200 lb/lineal in. Here are some impressive examples of precision welding:

Figure 1 shows the results of production welding a precision

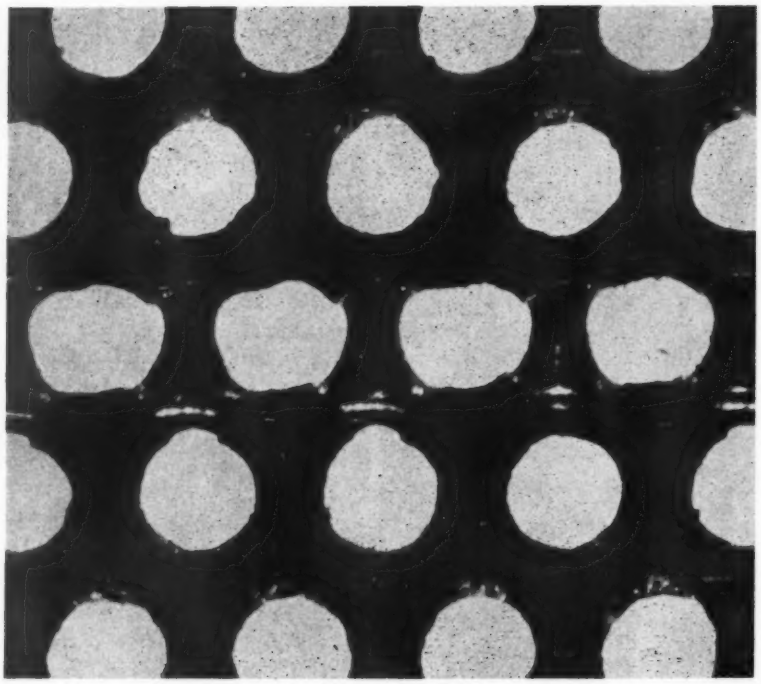


Fig. 1. Welded, etched stainless screen.

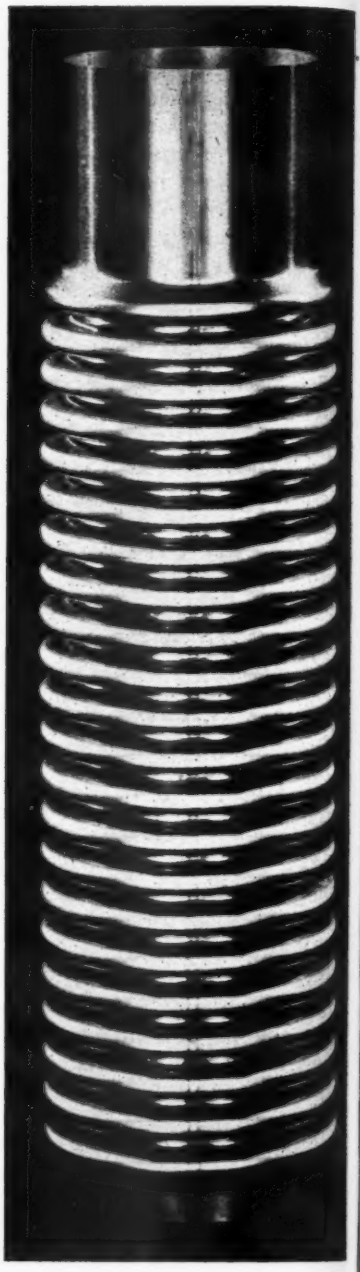


Fig. 2. Stainless bellows.

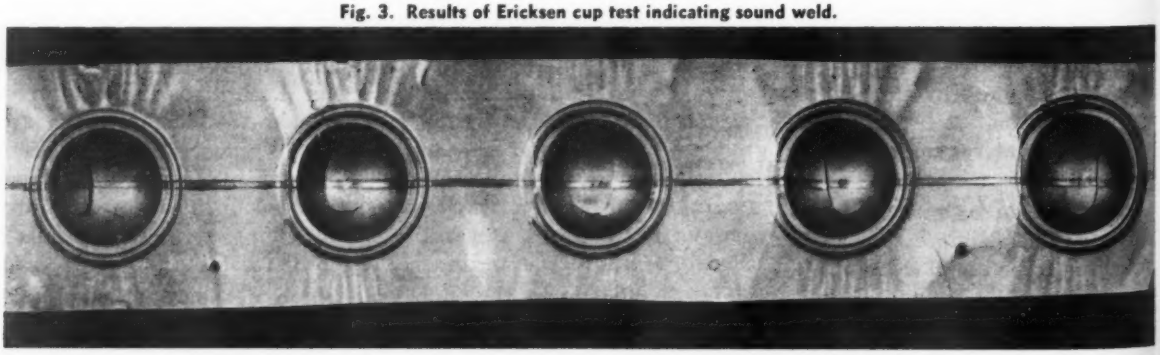
etched stainless steel screen. This enlarged picture of a 0.015″ thick screen shows the weld section of a cylinder. The weld was made without altering the geometry of the holes or the hole pattern. There are 260 holes psi, each only 0.040″ in dia.

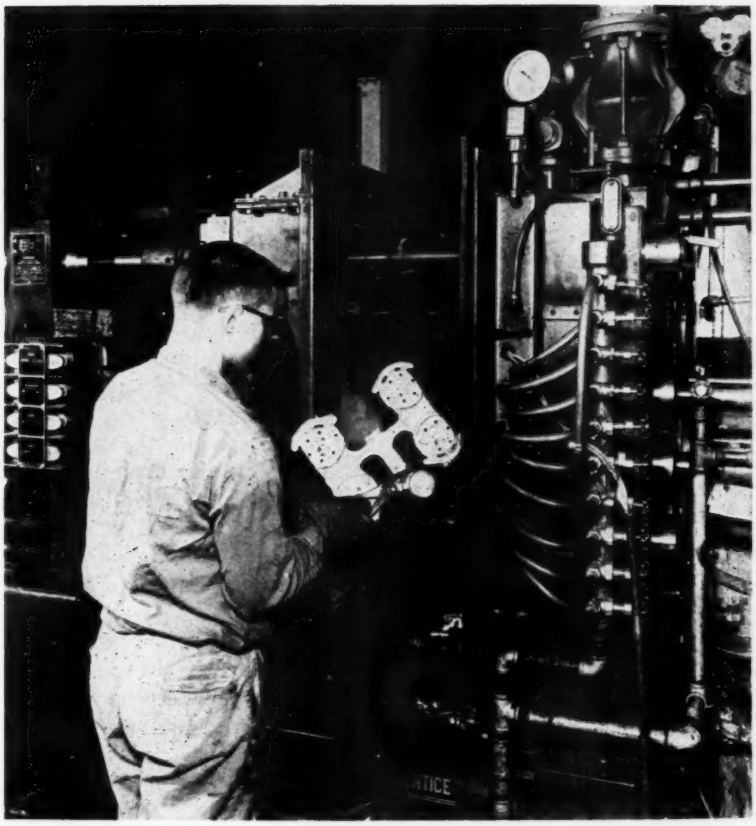
Figure 2 shows an aircraft bellows made from 321 stainless. First welded into a tube it is then roll planished and finally convoluted. Tolerances on the dia. are +0.010″, —0.000″. As an alternate method, the bellows could have been made from tubing. But since the alloy is special, the tubing would come at a premium due to the necessity of a special mill run. Projected saving is 60%.

Figure 3 shows the results of an Ericksen cup test indicating a sound weld. All fractures occurred across the weld in parent metal, rather than along the weld axis.

As to the sales plan, its prime purpose is to bring the price of the machine within the reach of small industry. Orders are filed until five machines are on order, then production starts. Delivery date of all machines is four weeks following receipt of last order. They say the price of each machine is thus reduced by 40%. —W. E. H.

Fig. 3. Results of Ericksen cup test indicating sound weld.





Vacuum Valve Offers Reliability

*by Robert Montgomery**

The vacuum diecasting process has created new standards of quality. Castings produced in hot-chamber machines are less porous with better surfaces, thus reducing the finishing necessary for painting and plating.

Castings produced under vacuum can stand higher subsequent heat and it is often possible to run larger castings, or more castings, in a single die since injection pressures can be reduced and still yield sound products. Further, the metal flow is freer and castings can be produced with extremely thin wall sections.

"CONTINUING" PRODUCTION IS TOO OFTEN the only test of reliability for components of machine tools or tooling. A short can put a million-dollar transfer machine out of business. Or, a leak in a hydraulic valve can cost thousands of dollars in lost production and downtime expense. After all, a machine is only a collection of parts. Each part is vital, and deserving of

*Engineer, Schaal Associates, Lexington, Massachusetts.

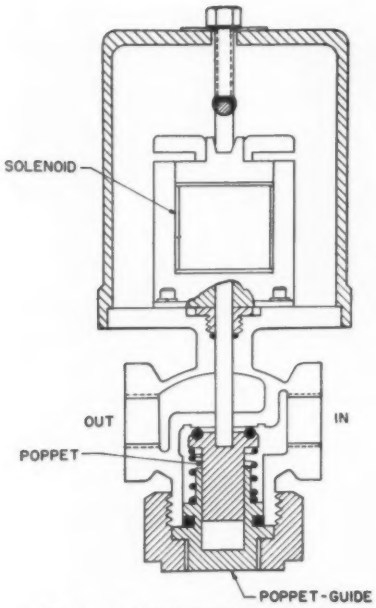


Fig. 1. A direct-operated solenoid vacuum valve, designed for extreme reliability. The valve features just two moving parts.

deliberate consideration of its "facts of life"—particularly set-up and maintenance.

Often the success or failure of a machine or process will hinge on one or two relatively inexpensive components. One example of this is the vacuum diecasting process developed by Nelmore Manufacturing Co., Euclid, Ohio.

This Vacufeed process (now furnished by Package Machinery Co.) consists basically of removing most, or as much as possible, of the air from the die cavity before injecting the molten metal. The stationary and moving platens of the machine are surrounded by a two-piece hood, one half of which is fastened to each platen. A rubber flange on the hood forms an airtight seal. At the start of the cycle the platens close, the hood seals off the die area, and the area inside the hood is evacuated through a 4" vacuum line. A vacuum of 20 to 28 in of mercury (approximately 10 to 15 psi) is created in the die chamber.

After casting, air must be allowed to enter the die area before the dies can be opened. That is when (and where) a reliable valve is needed. It opens to atmosphere and equalizes the pressure inside and outside of the hood.

Lack of a dependable valve, we are told, created no end of trouble when the first machines were built. The conditions under which the valve must operate are extremely severe, and it must operate as often as once every 9 sec. You can imagine what this does to O-rings and solenoids! If the valve lets air leak into the chamber during the casting cycle, the casting may be ruined. Then again, if it fails to open quickly at the end of its cycle, production will be slowed and excessive strain put on the machine.

Basically, the process consisted of an idea and a bit of hardware. But, the hardware had to function properly. One seemingly unimportant piece was a 2" solenoid valve—finding the right one was a real bug. The right one turned out to be a valve manufactured by the Airmatic Valve Co., Cleveland, Ohio. Here reliability is the first requisite, with long life playing a vital part. The valve had to seal, leak-free, against a vacuum of 28" of mercury. It had to be able to operate up to 400 cph, and in an area where air temperature reached 250°F. Specifications like these are "killers" for solenoids.

Factors contributing to the reliability of the valve standardized for this application are:

1. Full-capacity air flow; there is no pressure drop or venturi effect within the valve itself.

2. The valve is a directly-operated solenoid valve.

3. It uses low-amperage for prolonging its life. The inrush current is 5.5 amps and sealing current is 0.8 amp at 110 v AC, 60 cycles. The poppet has a booster spring to balance its weight. This plus vacuum holds the valve closed.

4. A Veeco mass-spectrometer is used for 100% inspection. The spectrometer uses helium as a tracer, and is sensitive enough to detect 1 part leakage of helium in 10 million parts of air.

5. The poppet and its guide are a complete sub-assembly. After the poppet and guide are assembled, the O-ring seat in the poppet is precision ground to assure parallelism with seat. The end of the housing and the valve seat are machined in the same setup so O-ring seats perfectly, having exactly the same sealing pressure over its entire surface.

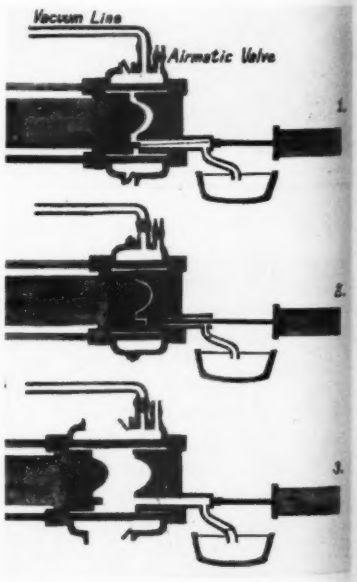


Fig. 2. During Vacufeed, vacuum draws molten metal from the furnace into the charging chamber. From there it's forced into the die. #1 shows the die closing with the Airmatic valve closed and the vacuum valve open. Metal can be drawn into the injection chamber since a hood seals the cavity even though it's not completely closed. #2 shows the die, the vacuum valve, and the Airmatic closed. At this time molten metal is forced into the cavity. #3 shows the Airmatic valve and cavity open, and the vacuum valve closed. Here the part is removed.

CIRCLE INFORM-A-GRAM KEY NO. 53

Hot Forming Steel Plate

*by M. J. Bajorek**

THE HOT FORMING OF STEEL, particularly rolled plate products, involves more than the application of sufficient heat to reduce the tensile strength of the material. Consideration must be given to the material and job specifications, prior heat treatment, and welding specifications before the hot forming procedures can be established.

A knowledge of prior heat treatment is necessary because the various heat treatment operations cause specific changes within the steel which affect its physical properties, and subsequent heating during hot forming may considerably alter these properties. To further complicate matters, material is sometimes purchased in the as-rolled condition using the hot forming operation as all or part of the required heat treatment. "As-rolled" plate is material which has been reduced to its final thickness from a slab or ingot at the mill by hot rolling and has not received heat treatment.

Upon heating and cooling steel, changes take place in the microstructure accompanied by thermal, magnetic, and dimensional changes. The temperature range through which these changes take place is called the critical temperature range (from 1330°F to 1550°F for most carbon and low alloy steels). These changes are very important to the plate fabricator for hot forming operations. Whenever steel is heated to within the critical temperature range, hot forming should not be attempted until the metal temperature has been raised to beyond the upper limit of the range and held at that temperature long enough to assure that complete transformation has taken place. Hot working may continue during cooling through the critical range without injurious results. If forming is attempted on partially transformed material, failure in the form of fracture may result.

Condition of Plate Important

A comparison of materials meeting ASME Specifications SA 285, SA 201, SA 212, SA 204, and SA 302 reveals that with the exception of SA 285, for which no heat treatment is specified, all plate over 2" in thickness must be normalized for grain refinement. The specifications permit the normalizing treatment to be performed either by the mill or by the fabricator in conjunction with the hot forming operation. Plates 2" and under are furnished and tested by the mill in the as-rolled condition or, when agreed upon between the mill and the fabricator, they may be furnished in the stress relieved, normalized, or normalized and stress relieved condition.

Therefore, it is essential to know the condition of the material as received from the mill. Plate received in the as-rolled condition may be formed at any temperature consistent with the capacity of forming equipment and ability to handle, observing only the precautions stated above concerning the critical temperature range. If, however, normalizing is to be done in conjunction with the hot forming operation, the temperature to which the material is heated is of fundamental importance.

Whenever the fabricator normalizes the plates during hot forming they are accepted on the basis of mill tests made on heat treated specimens. The mill test report lists the heat treatment temperatures used for the test specimens and this information is used to establish the temperature for hot forming. This temperature should be equivalent to and should not significantly exceed the normalizing temperature as stated on the test report. The plate should be allowed to remain in the furnace at the normalizing temperature for a minimum of one hour per inch of plate thickness before removing for crimping.

Where heat treating furnaces are not located near the forming equipment, or when a hardening and tempering treatment is required for the particular material, it may be desirable to perform this normalizing treatment as a separate operation after hot forming. The forming temperature is then only limited to temperatures outside of the critical range and (for higher temperatures) by ability to handle and furnace temperatures available.

When plate is furnished by the mill in the normalized only condition, it should not be heated to a temperature higher than 50°F below the normalizing temperature as stated on the mill test report. Again, the plate should be allowed to soak at temperature for at least an hour per inch of thickness before forming. A longer hold time might be recommended for heavy plate since the temperatures for

*Manager of Quality Control, Titusville Div., Struthers Wells Corporation, Titusville, Pa.

forming normalized plate will normally be 1575°F to 1625°F and will be only slightly above the critical temperature range with the possibility of incomplete transformation.

Plate material in the normalized and tempered condition or in the hardened (quenched) and tempered condition deserves careful consideration. The forming temperature for such material is limited to 50°F below the tempering temperature. Heating to temperatures significantly above this limit ordinarily enters the critical range with the subsequent dangers associated with partially transformed material. Heating to temperatures above the critical range places the material back into the normalized only condition with the resultant loss of specific properties developed by the tempering operation.

Although heavy plate to specification A 212 may occasionally be involved, the materials most likely to be encountered in these conditions are specifications A 204 and 302. Since these steels have some air hardening characteristics, they are tempered immediately after normalizing or hardening, especially for thickness 3" and heavier. The heat treated materials are then tested to assure that specification requirements have been complied with. Therefore, any subsequent heating to temperatures in excess of the tempering temperature would void the test results and require re-testing.

Capacity of Equipment

The hot capacity of bending equipment is generally based on sufficient heating to reduce the strength of steel to about 25,000 psi tensile and about 18,700 psi yield. For carbon steels this indicates a temperature of approximately 1000°F at completion of forming, while the temperature for low alloy steels may approach 1200-1300°F. The temperature at completion of forming is important since through the range 600° to 800°F, some grades of steel have higher tensile strength with marked reduction in ductility as compared with room temperature values.

When the capacity of forming equipment requires that the forming operations be done hot, it naturally follows that the same equipment will be considered for any corrective re-forming. This re-forming may be required upon completion of heat treating operations. For example, normalized and tempered or hardened and tempered operations may result in distortions beyond permissible tolerances. In this case, the re-forming temperature will be limited as stated above and will be considerably below the original hot forming temperature with the result that the capacity of the forming equipment may be exceeded.

Re-Forming After Welding

It is sometimes desirable to re-form after completion of subsequent fabrication operations, for example, after completion of the welding of a longitudinal seam in a shell course. In this particular case, the re-forming temperature normally is limited to the proposed final stress re-

Heat Treatments referred to in this article

Stress Relieving (Stress Relief Anneal) — Heating to a temperature below the lower critical temperature, holding for a sufficient period of time, and cooling slowly under controlled conditions. It is done to reduce internal stresses caused by rapid cooling, welding, and forming operations. (Typical stress relief temperature—1100°F to 1200°F.)

Normalizing — Heating to approximately 100°F above the critical range, holding for a sufficient period of time and cooling in still air. It is used to obtain grain refinement, uniform crystalline structure, and uniform distribution of chemical constituents. (Typical normalizing temperature — 1650°F.)

Annealing—Heating to approximately 100°F above the critical range, holding for a sufficient period of time, and cooling slowly in a furnace or in a medium which will prolong the cooling time as compared to air cooling. It is used to induce maximum softness and ductility. (Typical annealing temp. 1650°F.)

Tempering (Drawing)—Heating to a temperature below the lower critical temperature, holding for a sufficient period of time and cooling either in still air, or at an accelerated rate. Done immediately after hardening and may or may not follow normalizing depending upon the material. For material which will become part of a stress relieved weldment, the tempering temperature will exceed the proposed stress relief temperature by 50°F to 100°F. Tempering is used to develop the specific mechanical properties required at the service temperature of the final product. (Typical tempering temperature 1225°F.)

Hardening (Accelerated cooling)—Heating to a temperature above the critical range, holding for a sufficient length of time followed by quenching. This treatment produces a greater hardness than that obtained by normalizing and is always followed by tempering. (Typical hardening temperature—1650°F.)

Table I—Typical Mechanical Properties for Deposited Weld Metal

Material	Condition	Minimum Required ASTM Specs (psi)		Reduced Section Tensile* (psi)		All Weld 0.505± (psi)		Elong. %	Reduction of Area %
		(ult.)	(yield)	(ult.)	(yield)	(ult.)	(yield)		
A 212 Gr. B	S.R.	70,000	38,000	81,450 82,800		82,500	67,500	27.0	63.9
A 212 Gr. B	N.& S.R.	70,000	38,000	69,700 69,600	38,000 40,700	68,000	45,000	33.0	63.5
A 204 Gr. B	S.R.	70,000	40,000	71,900 76,200	49,100 53,000	76,000	64,000	31.5	66.0
A 204 Gr. B	N.& S.R.	70,000	40,000	71,700 70,750	51,000 51,700	71,000	50,000	32.5	62.5
A 302 Gr. B	S.R.	80,000	50,000	86,000 85,600		81,500	55,000	30.0	63.0
A 302 Gr. B	N.& S.R.	80,000	50,000	77,700 80,500	54,600 55,500	77,000	48,000	32.0	65.8

S.R. = Stress relieved @ 1150°F.

N.& S.R. = Normalized @ 1650°F, followed by stress relief @ 1150°F.

* Specimen (taken transverse to the weld) composed of parent metal and weld metal.

± Specimen (taken longitudinally to the weld) composed of deposited weld metal only and machined to 0.505 sq in cross sectional area.

lief temperature, but the welding specifications must be examined before arriving at a proper procedure. The weld metal deposited has physical properties depending upon its condition. Stress relieved weld metal is usually, but not always, lower in ultimate strength and yield strength as compared to its as-welded condition. Weld metal which has been heated to annealing or normalizing temperatures may be expected to exhibit still lower strength levels.

This does not mean that weld deposits are never annealed or normalized. The important fact is that the characteristics of the deposited weld metal may be seriously altered by indiscriminate heating of completed welds to temperatures above the transformation range. In some cases the desired physical properties of the weld metal can only be obtained by appropriate heat treatment, but it is of fundamental importance that any heat treatment be consistent with the welding specification requirements in regard to the condition of weld deposit at time of physical testing. At no time would test results based on a stress relieved welded test plate be acceptable to represent a weld seam which had been heated to temperatures significantly in excess of the stress relief temperature.

Test Results

To emphasize the effect of heating on deposited weld metal, tests were conducted on welded test plates in both the stress relieved condition and in a normalized and stress relieved condition to simulate a weld seam which had been reheated above the transformation range for the re-forming. The results of these tests are listed in Table 1 and are to be considered as representative of what may be expected under similar conditions. A reduction in tensile and yield strength was produced in all cases where the test plate was normalized and stress relieved and in the case of A 212 and A 302 material, the normalized and stress relieved plates exhibited properties below the minimum required by specification.

The above constitutes some of the major factors which must be considered before attempting hot forming of steel plate. After the proper procedures have been developed, it is then necessary to establish adequate control measures to insure that the procedures will in fact be followed by operating personnel. This can best be accomplished by furnishing the furnace operators with specific written orders, prepared by Engineering and approved by the Metallurgical Department. Compliance with the heat treatment orders must be checked by Inspection and any deviations reported to Quality Control for corrective action. Responsibility for heat treatment operations and communication channels must be definitely established to avoid the possibility of improper treatment with the resultant corrective expense. Only with these features incorporated into the heat treating program can the interests of both the fabricator and the customer be adequately protected. end

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Book Reviews

DIRECTORY AND BUYER'S GUIDE — GRAY IRON CASTINGS. Published by Gray Iron Founders' Society, Inc., National City-East Sixth Bldg., Cleveland, Ohio, 1959. 75 pages, paperbound, free to users.

Producers of gray iron castings are listed alphabetically and geographically in the Directory section of this book. Facilities, production, foundry classification, and other pertinent facts are listed for each company. The Buyer's Guide portion provides a ready reference on sources of 140 different classes of the most common castings.

FLUID-POWER CONTROLS, by John J. Pippenger and Richard M. Koff. Published by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York, N. Y., 1959. 254 pages, $9.

Valves used for fluid power control are the major subject of this practical guidebook. It describes their construction and operation, their proper use in hydraulic circuits, and how to maintain them for best service. Pumps, reservoirs, piping, development of hydraulic circuits, and methods of preventive maintenance and machine repair are also discussed.

The book explains the growth of "extreme dependability" units such as oil-immersed solenoids and independently drained pilot mechanisms for the automation of machinery. Included is material on life expectancy of components, limitations of service, and best choice of component design.

Cutaway and schematic drawings of valves and circuits clearly demonstrate the points covered. A helpful glossary of terms, and a section on JIC hydraulic standards round out this thorough book.

SHOT PEENING. Published by Wheelabrator Corp., Mishawaka, Ind., 1959. 193 pages, $2.50.

A detailed explanation of the shot peening process for engineers and production men is presented in this revised edition. The first part of the book covers applications and advantages of shot peening and the equipment and procedures involved. The second part deals with the theory of prestressed surfaces in relation to shot peening and reviews the history of surface compression methods and their relation to fatigue. Numerous illustrations add to the value of the book.

MATERIALS FOR ROCKETS AND MISSILES, by R. G. Frank and W. F. Zimmerman. Published by the Macmillan Company, 60 Fifth Ave., New York, N. Y., 1959. 124 pages, $4.50.

Engineering data on the lightweight, high temperature metal and ceramic materials needed for rockets and missiles have been compiled in this book. The comparison of chemical composition and physical properties of different alloys, cermets, and ceramics acquaints the reader with available materials and their uses and helps him keep abreast of new developments. New material fabrication processes, including high temperature brazing, are also described.

THE BOOK OF THE LATHE, by C. T. Bower. Distributed by The Macmillan Company, 60 Fifth Ave., New York, N. Y., 1959. 192 pages, $3.50.

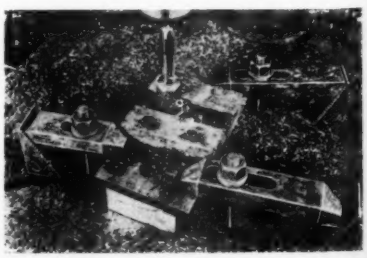
This practical handbook gives a detailed description of the center lathe as well as advice on the selection, care, protection, and adjustment of the machine. Various turning processes are explained and useful information on gadgets, special tools and short-cuts are included. Close up photographs and drawings make this book even more valuable to novices and highly skilled turners alike.

MATHEMATICS FOR INDUSTRY, by S. E. Rusinoff. Published by American Technical Society, 848 East 58th Street, Chicago, Ill., 1958. 565 pages, $6.25.

Mathematics needed to solve practical shop problems are presented in simplified form in this book. Starting with a review of shop arithmetic, the author then discusses simplified algebra, plane and solid geometry, shop trigonometry, logarithms, graphs, and the use of the slide rule. Application of shop mathematics to screw threads and gears, methods of computing deviations of a process, and techniques for inspection and quality control are also dealt with.

Temporary Fixturing Makes Job Profitable

Temporary fixtures, quickly set up with step blocks and clamps for short run production, save time and money. This temporary fixture was mounted onto a drilling and tapping machine in 15 min at Northwestern Tools, Inc. The complete job, including setup time, drilling, tapping, and spot facing 50 special hand knobs required only 1 hr and 35 min. Clamping tools helped cut costs by over 50% and the small quantity order showed a profit. For details, circle I.A.G. No. A6.



UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel —the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

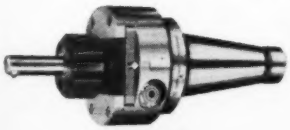
213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

Standard Collet Chuck

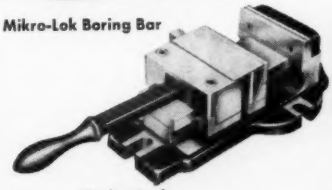
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 8, MICHIGAN

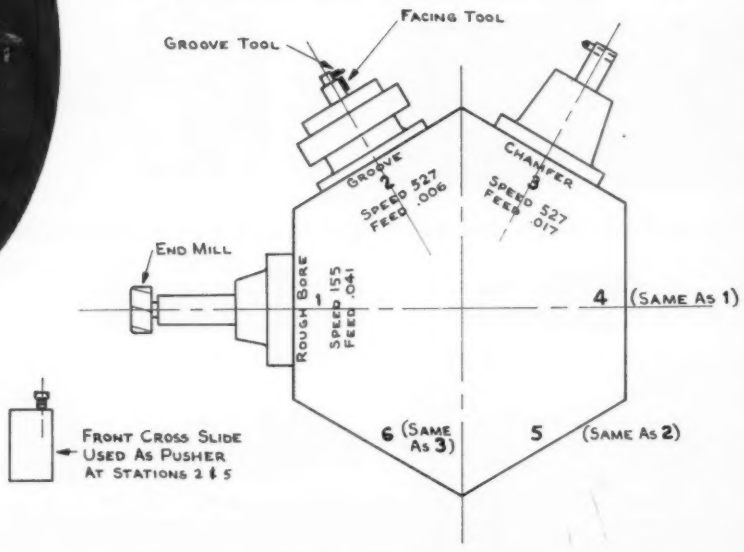
CIRCLE INFORM-A-GRAM KEY NO. 59

Fig. 1. Operator starts loaded second machine before turning to unload semi-finished part from the first machine.

Production Increase

More power and throwaway tips make the difference

Fig. 2. Double-tooled hex turret for machining part shown at left.



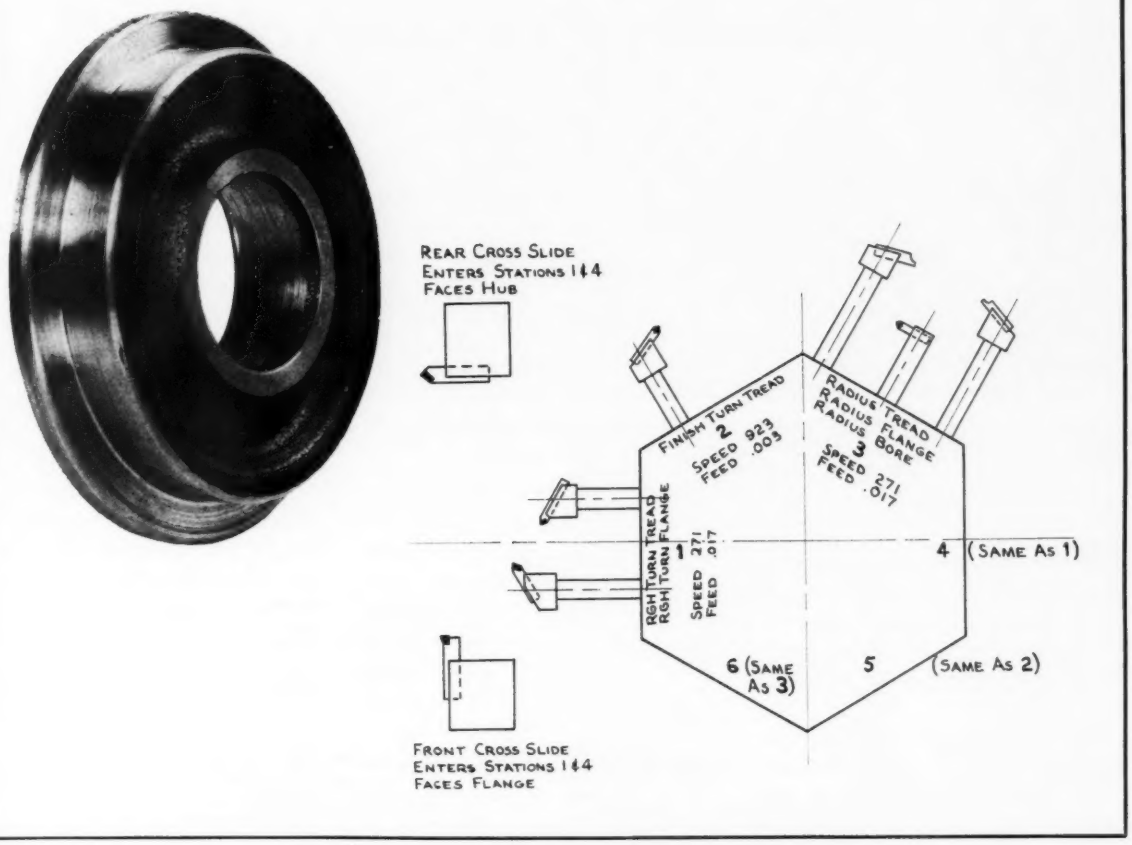


Fig. 3. Finished part and tooling used to do the machining.

A 300% PRODUCTION INCREASE at 100% efficiency is worth consideration. It came about at the Cleveland Crane & Engineering Company in production of wheels for their Tramrail cranes.

Varying in dia from 3" to 9", the forgings of 1137 steel, are machined at 26 Rock.C. It takes the operator and two Potter & Johnston automatic turret lathes one shift/day to keep up with production requirements. But things were not always this good. Before purchasing more powerful lathes, and using a throwaway carbide tip approach, they were getting only 14 wheels/hr; often production was less, due to stalling and burnouts. Now production is up to 49 wheels/hr.

Another aid to long tool life, and a consequent increase in production, is directly attributed to isolation mountings, says Lee Elliott, Cleveland Crane's Chief Tool Engineer. These machines are virtually free from outside vibration, which accounts for an excellent microfinish.

Along with an increase in tool life, which makes for a minimum of setup time, the hex turret is double tooled as noted in Fig. 2 & 3. Three stations are all that are needed but the other three have identical tooling. Indexing time, through what would otherwise be blank stations, is eliminated.

Figure 2 shows a finished part and tooling layout for the turret of the first lathe. Operations are as follows: Sta.1 is for rough boring with an end mill. Sta.2 faces with a quick acting tool slide; a snap ring groove is cut simultaneously. Sta.2 c'bores and faces.

Figure 3 shows a finished part (opposite side from that shown in Fig. 2) and tooling layout for the turret of the second lathe. Operations are as follows: Sta.1 rough turns both OD's and also turns the flange face with the front cross slide. The rear cross slide faces the hub. Sta.2 finish turns the small OD. Sta.3 adds two radii and chamfers the bore.

All tools except end mills and those used for turning radii are equipped with reversible throwaway carbide tips. By reversing, no setup time is necessary and eight cutting edges are available/tool. **—W.E.H.**

The editor projects a bright future for

Quality Pre-Control

by E. Willard Pennington

A NEW DEVELOPMENT in optical projection overcomes the last obstacle to your making full use of the optical comparator in Quality Pre-Control, an inspection technique devised by Jones & Lamson Machine Company, Comparator Division, Springfield, Vt., and first published in 1954.

A greatly increased screen brillance and shadow contrast at high magnifications are the result of their introduction of a high pressure mercury arc lamp unit which provides approximately five times the light intensity of the brightest tungsten filament lamps.

This so greatly multiplies the applications of J & L's System of Quality Pre-Control that the optical comparator now becomes a fast working go/not go gage of here-to-fore unattainable sensitivity.

Pre-Control, in short, is a simplification of quality control techniques — needing no charts, graphs or calculations — that keeps production within allowable tolerance limits **while** the process operates.

J & L's 20-page publication "Quality Pre-Control" outlines the complete technique not only for use with the optical comparator but for other types of gaging as well. If you'd like a copy let us know—or circle our Inform-A-Gram A-8. It's well worth study and consideration by your quality control people.

Daylight Inspection

Gone are the days when inspection by the optical comparator has to be conducted in a dimly lighted area of your inspection department or when you have to hang funeral black drapes around the equipment to block daylight—and ventilation.

Mercury Arc and Power Pack

The mercury arc illuminating system is a replacement package adaptable to all J & L comparator models except their 7″ bench machines. As shown in Figure 1, the packaged deal consists of a power pack and a lamphouse. With the new lamphouse replacing the conventional (the changeover taking a matter of minutes), the power pack can be placed on the floor, bench, or attached to the side of the comparator.

The new mercury arc light means that the optical inspection operation can be integrated with production line stations, right out in the open under average shop lighting conditions.

Hand in hand with the viewing advantages which accrue from the great increase in screen illumination is the step-up in magnification which you can utilize, and which greatly broadens the inspection applications you can make of your comparator.

Magnification vs. Illumination

You will recall that with a given light intensity, as you use projection lenses of the higher magnifications, there is a proportionate fall-off in screen brightness and shadow contrast. When this is carried to the point of extremely high magnifications, not only is the shadow edge in poor contrast with the screen, but your tolerance zones and other datum as marked on the screen are not so readily distinguishable as to make for fast and easy checking.

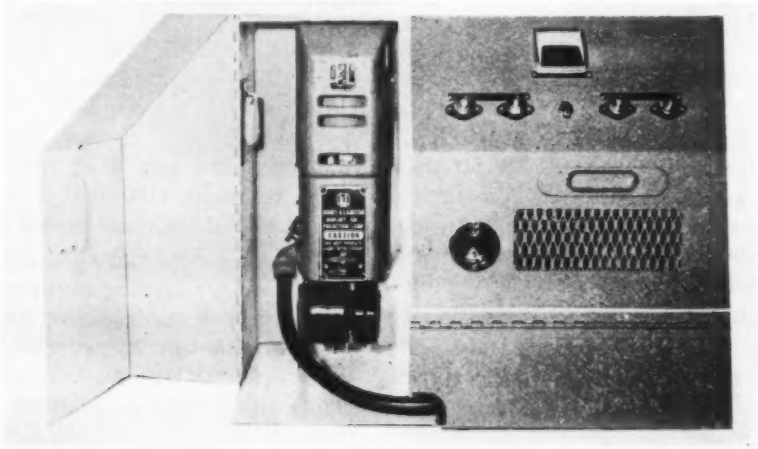


Fig. 1. Replacement kit consists of mercury arc lamphouse (in compartment, left) and power supply. Stability of arc is obtained by use of a controlled voltage transformer, silicon bridge rectifier, and capacitance filtering. Lamp settings, rheostat controlled, are on voltmeter and ammeter. Automatic starting circuit protects lamp from overlong application of the arc-forming voltage.

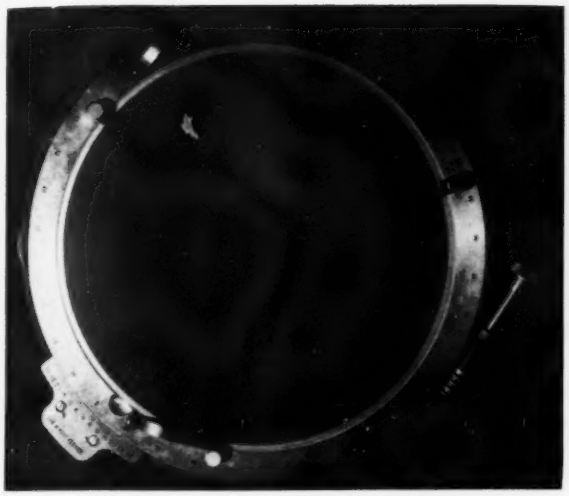


Fig. 2 (above). Projection of tracer stylus on 14" comparator screen at 100x. Contrast and illumination are limited by old style tungsten filament lamp. Tolerance band (0.001") is not of brilliant enough contrast to easily divide into lesser parts. This contrast would be further diluted by surrounding daylight.

Fig. 3 (above, right). In contrast with Fig. 2 is the same setup using new mercury arc illumination. With this screen brightness consideration need not be given to room lighting. The mercury arc lamp gives improved definition and contrast to the shadow boundary and tolerance markings. The tolerange zone (0.100" wide on the screen) can be split into increments of a few "tenths."

Fig. 4 (below, right). Same stylus projected on 14" screen at 10 magnifications with tungsten filament lamp. Same light source as in Fig. 1 but at one-tenth the magnification. For the photographic-minded all three photos were made with an exposure of 1 sec., thus depicting relative screen brilliance given by the tungsten filament and mercury arc sources.

Figure 2 shows the shadow profile of the point of an engraving stylus as projected on the 14" screen of a comparator. This is at 100 magnifications and with a tungsten filament lamp. Note that the screen's broken line tolerance band representing 0.001" on the stylus being inspected, although discernable, is not of great enough contrast with the screen's degree of illumination to allow easy "splitting" into subdivisions.

A Look at "Tenths"

Compare this with Figure 3 which is the same setup but with the new mercury arc illuminator. Now the tolerance band stands out "loud and clear" and has become a fast working inspection tool. With this brilliance, a line representing 0.0005" could be added, and by eye you could easily make another split to 0.00025".

At a magnification of 100x, 0.001" on the stylus becomes a whole tenth of an inch on the comparator's screen—thus making inspection by optical projection workable to "tenths."

Figure 4 shows the same stylus projected at 10 magnifications with a tungsten filament light source. At this low magnification the 0.001" tolerance band has merged with the shadow profile and become a lost cause.

Bright Screen At 100x

Recall that we mentioned earlier the falling off of screen brilliance from a given light intensity as magnification is increased. Figures 2 and 4 illustrate this admirably.

In both cases, the illumination was from the tungsten filament lamp. Working with 100 magnifications the screen in Figure 2 is inadequately illuminated and of low contrast, whereas with a low magnification of 10x the screen is bright but at that low magnification we have lost inspectability in tenths. And again, Figure 2, at 100 magnifications, with the new mercury arc illuminator paints a brighter picture of those elusive "tenths."

With our "tenths" now standing out to be counted, J & L's Quality Pre-Control can be put to work by optical inspection.

A reminder: you better get the "Quality Pre-Control" booklet and try the technique for size. As we said, ask us for one or circle Inform-A-Gram A-8. end

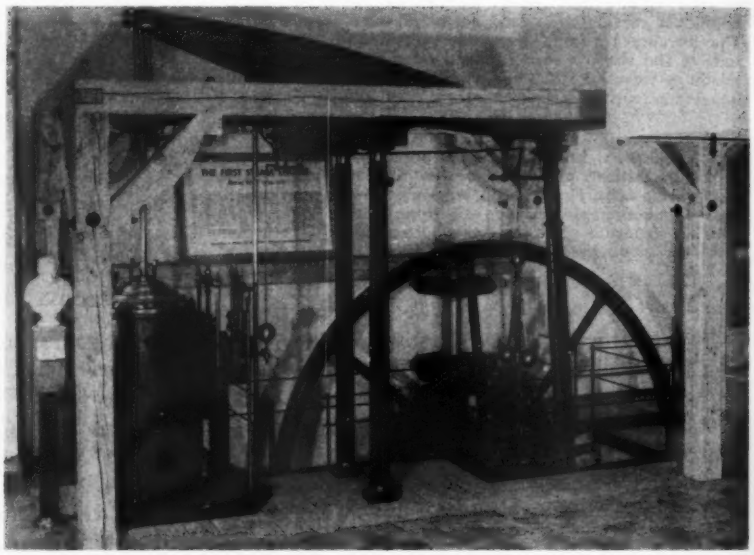
This addition to the company's Des Plaines headquarters houses the Hall of Progress, machine tool Demonstration-Test Center, and educational exhibit "The Dawn of This Age." You are invited.

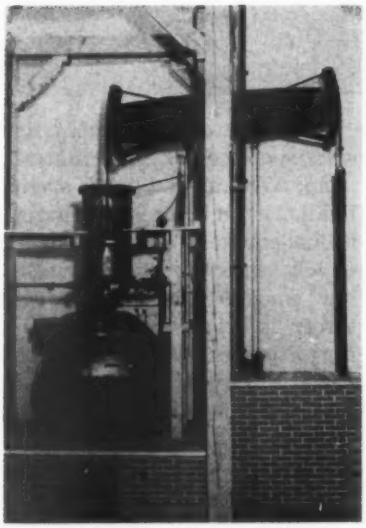
Leighton A. Wilkie
"Mr. DoAll"

Collector's Items . . .

DoAll's Hall of Fame

An original James Watt steam engine, the only one in America. Built in 1799. Its 60-hp, 16 ft flywheel turned English textile mill machinery for nearly 150 yrs. It was in good operating condition when dismantled for shipment to Des Plaines where you can now see it, powered by a concealed electric motor.





A cut-away, quarter-scale replica of a 40-ft-high Newcomer "atmospheric" engine, the forerunner of the Watt steam engine. Pressure of the atmosphere, exerted through the open-top cylinder, drove the piston down into a partial vacuum that had been created by an injection of steam followed by a jet of cold water. James Watt got the idea for his steam engine while repairing a model of the Newcomer engine for the University of Glasgow, where he was employed as an instrument maker.

A QUITE INSPIRING SIGHT in Des Plaines, Illinois, is The DoAll Company's Hall of Progress, containing historical and educational exhibits which pace man's material progress from the stone tool age to today's high production machine tools.

The permanent historical presentation occupies one side of the hall. The other side houses DoAll's Demonstration-Test Center.

This historical collection of tools and machines has been abuilding through the efforts of Leighton A. Wilkie, Chairman of the Board of The DoAll Company. In this he has been enthusiastically supported by his brothers, James W. and Robert J., who head up, respectively, DoAll's Manufacturing and R&D activities.

The recent formal opening and dedication of the Hall of Progress and "The Dawn of This Age" educational exhibits, included a dinner sponsored by the

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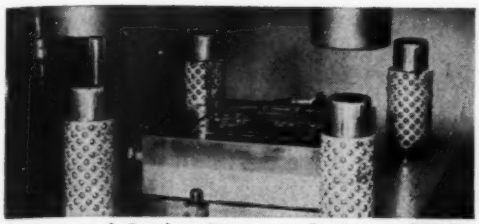
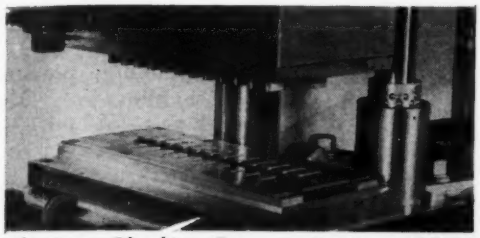
eloxing

will put you ahead of competition



Compound Gasket Die . . . Savings: 20%



Aluminum Blanking Die . . . Savings: 50%

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A full-size replica of the world's first machine tool—the boring mill. The original was invented by John Wilkinson, an English foundryman, to bore cylinders accurate enough to hold steam pressure. This attainment climaxed a 10-yr struggle by James Watt to build man's first mechanical power plant—the steam engine.

Sharing space in their Hall of Progress is DoAll's Demonstration-Test Center where you are welcome to bring your machining and gaging problems. Tests and demonstrations are made to evaluate cost-reducing methods and to show how cutting, grinding, gaging and fabricating operations can be made profitable in the face of increased competition.

Newcomer Society in North America to honor The DoAll Company and Mr. Wilkie "for outstanding contribution of America's material and economic progress in the field of basic machine tools."

The accompanying pictures high-spot the exhibits to be seen in the Hall of Progress, which is open to the public.

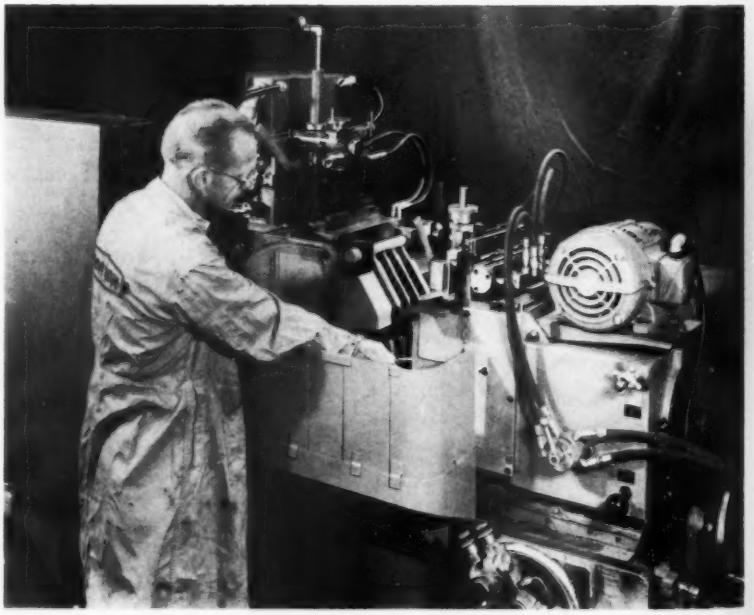
end

Norton's Centerless Debut

NORTON COMPANY'S NEW NO. 2 centerless grinding machine is the result of several years of R&D in ideal requirements for centerless grinding.

In a precision grinding machine with a capability of repetitive work to tolerances measurable in millionths, there can be no compromise in overall ruggedness. This is why Norton has incorporated straddle bearings on the grinding and regulating wheel spindles. These

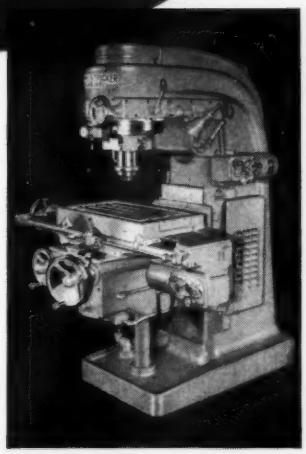
. . . continued on page 69

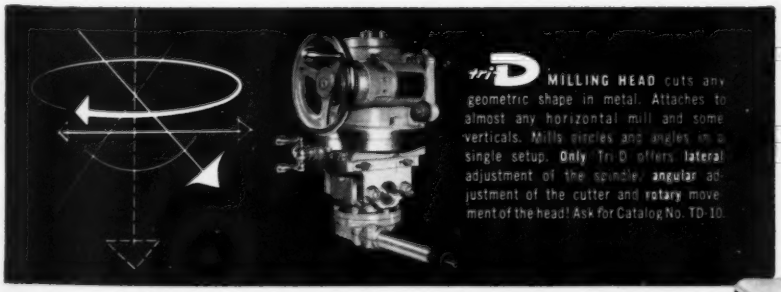


Norton Company's centerless grinder R&D included asking users of centerless machines for their suggestions on what features they would like to see incorporated in a new design.

Kearney & Trecker MODEL D ROTARY HEAD MILLING MACHINE

Change job planning time into profitable production time! Simplify and speed close-tolerance milling of tools, dies, molds and parts having multiple radii — on Die/namic-designed Kearney & Trecker Model D Rotary Head Mill. It ideally combines precise mechanical control of spindle offset and rotary head motion, so that straight, angular and radial movements can be effected — all in a single setup. In production work, Model D eliminates jigs, fixtures, models and templates. For facts, see your nearest Kearney & Trecker representative or write direct.





Tri-D MILLING HEAD cuts any geometric shape in metal. Attaches to almost any horizontal mill and some verticals. Mills circles and angles in a single setup. **Only** Tri-D offers **lateral** adjustment of the spindle, **angular** adjustment of the cutter and **rotary** movement of the head! Ask for Catalog No. TD-10.

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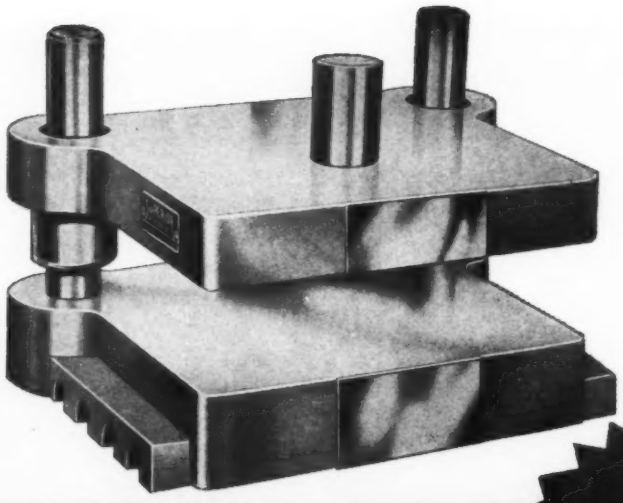

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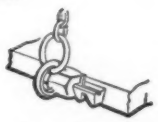
protects fingers by providing roomy gripping space on either side of the die shoe.



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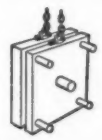
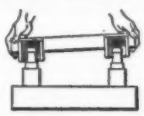
removes the danger of handling large die sets.



E-Z LIFT SLING CHAIN
attach to the lock-jaw for immediate lifting.



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CIRCLE INFORM-A-GRAM KEY NO.68

Norton's Centerless . . . from page 66

provide support on both sides of the wheel to prevent the deflection normally encountered when an extra wide wheel is mounted on the unsupported end of a spindle.

The straddle bearing construction contributes also to size and straightness control of workpieces, consistent sizing of the thru-fed parts even when loading is interrupted, and to accuracy of wheel truing because there is no deflection under truing pressure.

Norton's entry in the centerless grinder field employs a grinding wheel slide with rotating feed screw for precise wheel-feed on plunge grinding operations or fine adjustment for sizing on thru-feed grinding.

Sensitive wheel-feed in increments of 0.000050" is attained by a click-count handwheel index.

Where two or more machines are tied together by conveyors in a single production line, the new Norton design offers extreme ease in work loading alignment. Since the grinding wheel is fed to the work, the work feed center line of both the machine and the conveyor remains fixed. As the wheel wears, the wheel slide is moved closer to the work rest. The work rest remains in one position and there is no need for constantly resetting it on the work conveying equipment.

end

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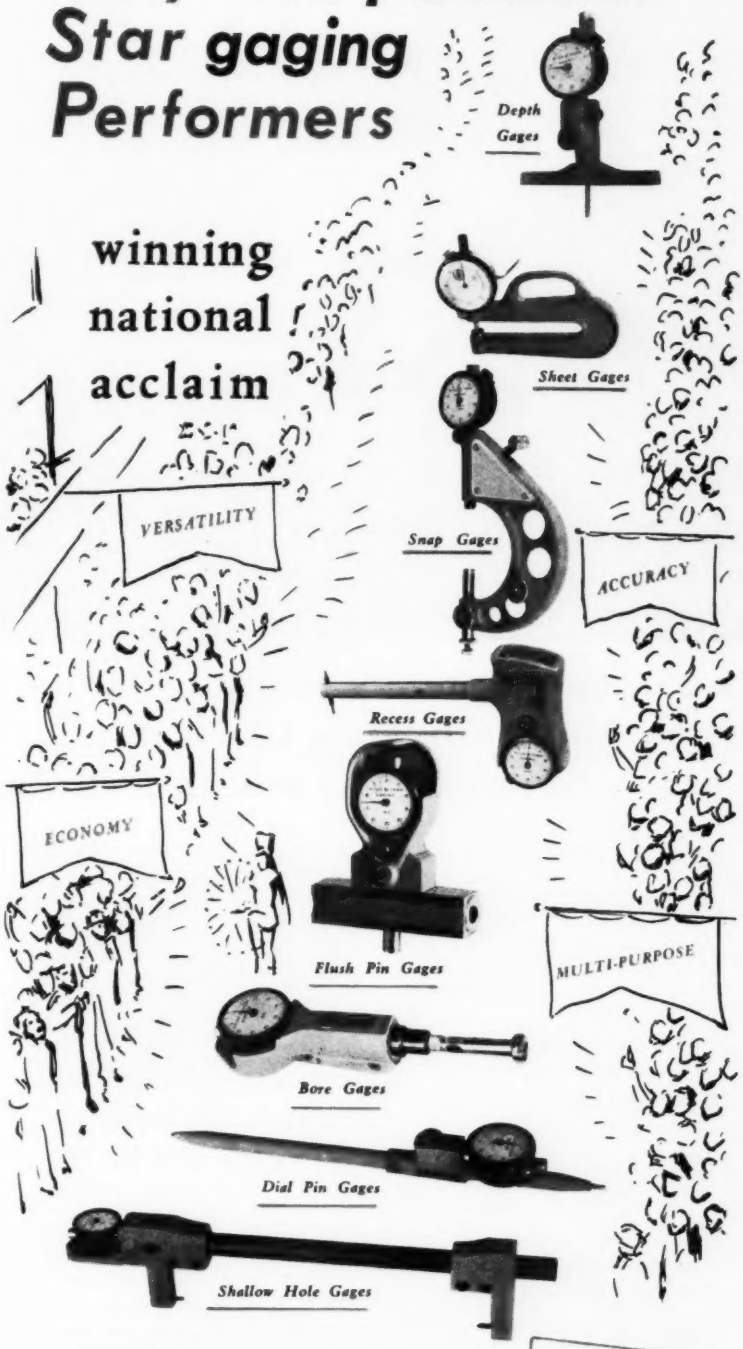

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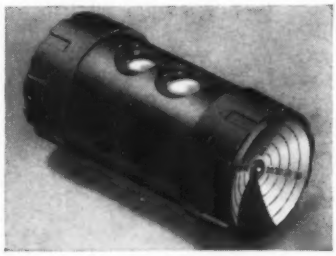
If your work demands a greater magnification range you can select a Magni-Changer "M" CYCLOPTIC... provides 5 different magnifications for each eyepiece/objective combination through a wider resultant magnification range of 3.5X to 80X.



Fixed Body Magnification

The popular, still lower-cost CYCLOPTIC "F" Models offer a fixed body magnification for those many applications where instantly changing magnifications are not required. Resultant magnifications can be varied from 10X to 40X by interchanging eyepieces, objectives or auxiliary lens attachments.

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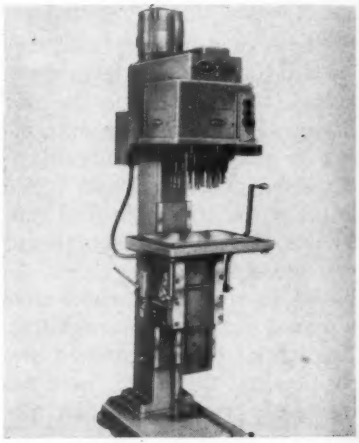
CIRCLE INFORM-A-GRAM KEY NO. 70

Multi-Spindle Drill Ups Production

Speedy and efficient drilling and tapping of up to 12 holes is possible with the multiple-spindle Deka-Drill. In a typical application on a motor end bell, floor-to-floor time is 610 pcs/hr with the Deka-Drill, compared to 46 pcs/hr with the old method.

This particular setup consists of 12 holes, six on each bolt circle. A box-type, pin-guided fixture is used, with the drill plate fixed to the top guide plate and mounted to the head of the machine with four spring pressure rods. The piece is held by the top plate during its cycle and located on the bore and one of its ribs on the bottom plate. Using two stations from left to right, one piece (12 holes) is drilled and counterbored with each pass.



The Deka-Drill, made by Precision Tool & Manufacturing Co., Cicero, Ill., uses a 2-hp, 1200 rpm, three-phase motor. A self-contained manually-operated hydraulic lift raises the knee by means of a few short strokes, eliminating the need for crank and gear assemblies. Opening of the metering valve allows the table to glide smoothly downward at an infinitely controlled rate.

Ram type, slide construction is used in the support and actuation of the table and knee. When

... Continued on opposite page

Students See Latest Horizontal Jig Boring

Recently 50 promising industrial engineering students from Case Institute of Technology, Cleveland, gathered with Professor Carl L. Bennett to learn about horizontal jig boring. They were guests of Otto Karoly, representative of Machinery Builders Inc., who furnish industry with the Dixi, the only horizontal optical jig borer made. (See T&P, Mar. '58, p. 57.)

After lunch and movies on the equipment and how it is used, they went to Sloan Machinery Co., where Jules Scholl, chief service engineer, gave demonstrations on both the Dixi 60 and the Dixi 75, big new jig borer. A question and answer period followed.

Prominent people in attendance included Emil Gibian, recently retired vice president and staff director of industrial engineering for Thompson Ramo Wooldridge Inc.; John Cherry, also of TRW; and Works Manager P. E. Schaffer, Works Engineer George Kluter, and G. Black, of The Warner & Swasey Co.

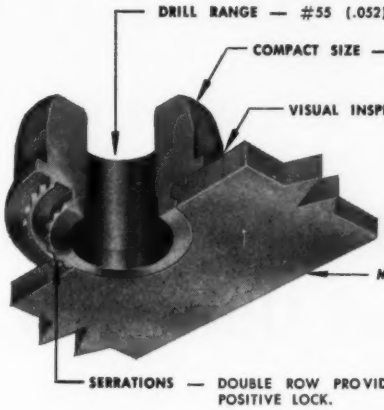
...**Multi-Spindle from opposite page**

the table is extended to its full 6" travel, the ram is always engaged in its slide, resulting in rigidity throughout the entire stroke. This method also permits a longer stroke than is ordinarily found in this type of machine.

The sealed, self-contained and lubricated gear box can be easily moved to allow insertion of fixed spindle heads. A deep coolant trough in the table returns coolant to a tank, which is part of a separate coolant assembly.

Precision also makes a hydraulically operated model of the Deka-Drill which is used for fully automatic cycles. Circle Inform-A-Gram No. A1.

FOR REAL DRILL TOOLING ECONOMY


DRILL RANGE — #55 (.052) THRU 9/64 (.1406).
COMPACT SIZE — MINIMUM HEIGHT ADEQUATELY SUPPORTS DRILL, DIAMETER PERMITS CLOSE LAYOUT.
VISUAL INSPECTION — WHEN BUSHING IS FULLY INSTALLED, ITS SHOULDER SEATS ON TEMPLATE.
MATERIAL — INSTALLED IN .060 OR THICKER ALUMINUM.
SERRATIONS — DOUBLE ROW PROVIDES POSITIVE LOCK.

Inexpensive Press Type Anchor Bushings are simply pressed into punched (or drilled) holes in .060 or thicker aluminum drill templates and offer durable tooling life for high or low volume production.

The compact sizes of these bushings allow you to lay out very close hole patterns, yet the bushings provide the necessary drill support for perpendicular drilling. The double row of serrations at the base provides a positive lock between the bushing and the template to resist drill torque or template abuse.

To simplify template hole preparation, drill sizes are accommodated by only three sizes of bushings:

AB90 #55 (.052) THRU 9/64 (.1406)
AB91 #27 (.144) THRU "F" (.257)
AB92 #G (.261) THRU 7/16 (.4375)

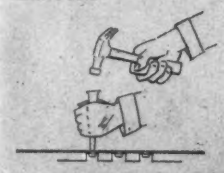
WRITE FOR OUR NEW BROCHURE ON PRESS TYPE ANCHOR BUSHINGS. IT TELLS HOW TOOLING ECONOMIES ARE OBTAINED, GIVES LAYOUT DIMENSIONS, INSTALLATION AND REMOVAL DATA, AS WELL AS ORDERING INFORMATION.

INSTALLATION

1
DRILL OR PUNCH HOLE IN TEMPLATE TO MATCH BUSHING PILOT DIAMETER.

2
PRESS BUSHING INTO TEMPLATE HOLE.

REMOVAL



KNOCK-OUT BUSHING FROM UNDERSIDE OF TEMPLATE.

hi-shear RIVET TOOL COMPANY
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CIRCLE INFORM-A-GRAM KEY NO. 71

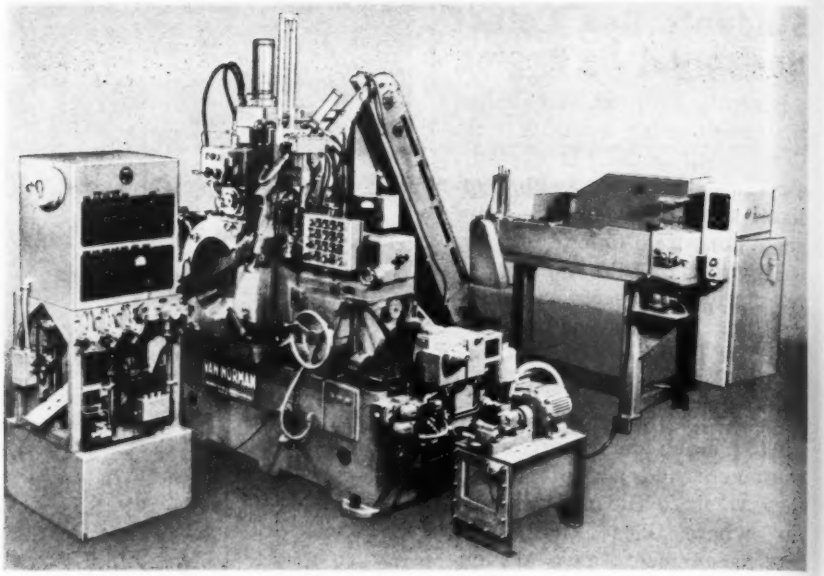
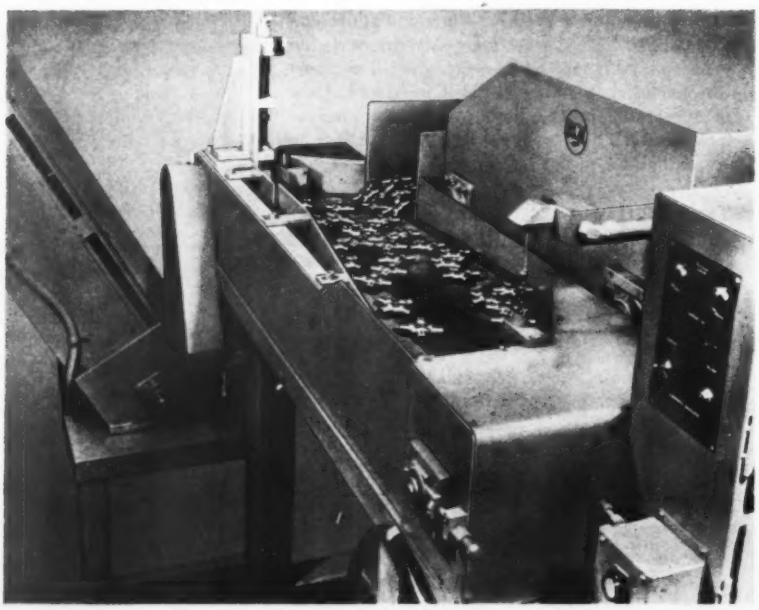


Fig. 1. Complete system for automatic grinding of universal crosses.

New System for Automatic Grinding of Universal Crosses

A COMPLETELY AUTOMATIC system for grinding universal crosses, recently announced by the Van Norman Machine Company, is expected to double previous production rates as well as substantially increase the number of pieces per wheel dressing. Two units have already been delivered to the Detroit Universal Division of the Chrysler Corporation.

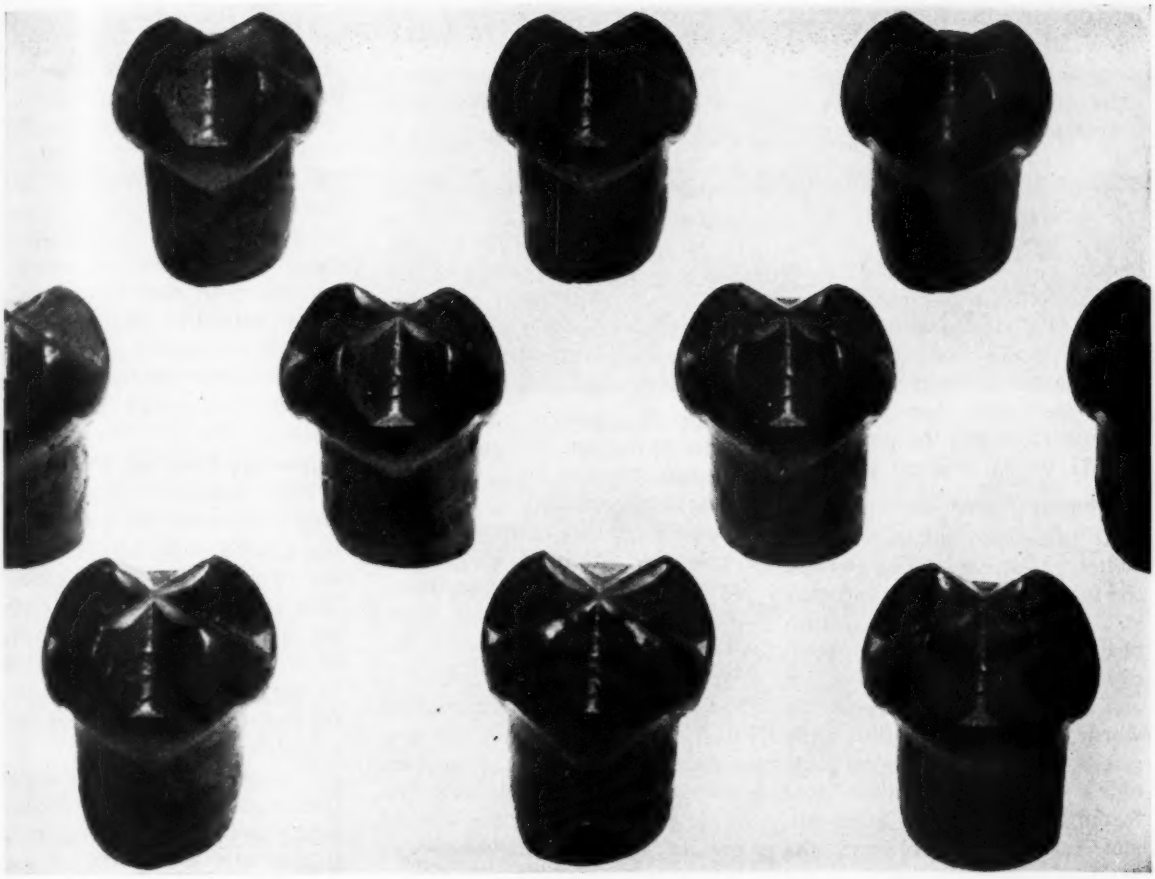


The system consists of a specially designed Van Norman 2C Diversimatic centerless grinder with electronic controls and parts handling devices provided by the Industrial and Automation Division of Radio Corporation of America. Feeding, loading, orienting, grinding, gaging, size control, and segregating are all automatic. Finish obtained is 15 rms and tolerances are well within the desired 0.0005″ since the limits of the gage are set at 0.0001″.

An RCA non-mar hopper orients and feeds the parts to an elevating conveyor which lifts them to a point above the loading and indexing fixture of the grinder. The cross is discharged

. . . Continued on page 74

Fig. 2. RCA Non-Mar Feeder provides controlled flow of crosses as required by the grinder. It utilizes a series of inclined planes and moving belts to feed the parts without damaging their finish.



It actually costs less to get uniform forged quality like this

THIS is an actual unretouched photo of rock bit forgings made from Timken® forging bars steel. It costs less to get this uniform forged quality when the steel is uniform. And Timken steel doesn't vary in structure, chemistry or dimension from heat to heat, bar to bar, order to order. You don't have to interrupt to make costly adjustments when you forge with Timken steel.

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TIMKEN® *Fine Alloy* STEEL

CIRCLE INFORM-A-GRAM KEY NO. 73

into the indexing-loading fixture, which deposits it onto a set of fingers or hooks. These operations are timed to the cycle of the grinder, thus insuring a continuous and even flow of parts without jamming. When properly located, a positioning mechanism lowers the part to the grinder's work-rest blade, at which point a micro-switch is energized. This causes the regulating wheel slide to advance rapidly, grind, and spark-out. The wheel-slide then automatically retracts and the part is returned to its original position.

Workpiece Added

At this point another micro-switch is activated and rotates the loading fixture and the cross 90°. As a second part drops into position in the fixture the positioning device is again energized and deposits both crosses on the workrest blade — the first cross already having two ground journals. The machine again goes through its grinding, spark-out, and retraction cycle and the parts are again returned to the indexing fixture which rotates them 90°. As the completely ground cross is ejected, another unground part is dropped into position and the cycle is repeated.

The ground cross slides down a chute into the RCA automatic gage. In doing so it contacts a micro-switch controlling a horizontal slide which positions the part on a set of V-blocks. A probe is automatically lowered over one journal and measures the diameter. As it is retracted the cross is rotated 90° and the cycle is repeated until all four journals have been checked.

The gage control panel has a series of five sets of signal lights, two/set. Those in the bottom row indicate the reading recorded by the probe during each measuring cycle. This information is stored by the unit until the four measurements have been made. Then the top row of lights shows the final results.

The first set of lights (amber) flashes if the part is undersize; the next set (green), if the part is approaching low tolerance; the middle set (green), if the crosses are in size. Approaching high tolerance limits causes the fourth set (green) to flash. Oversize parts are shown by a red set.

As long as parts are within tolerance the machine continues its regular operation, but if the gage determines that any three or four measurements in one cycle are on the high side, the infeed actuator is energized and the machine automatically compensates to bring the next part into the mean dimension. If three or four measurements are on the low side, the grinder stops, indicating that the wheel must be retracted slightly. Parts over or under the acceptable size also shut off the machine for resetting.

Automatic Dressing, Too

The controls automatically stop the grinder for wheel dressing after a predetermined number of pieces have been ground. This is done by the crush method, which forms the part's OD as well as the adjacent radius. The grinder will not operate until the dressing cycle has been completed.

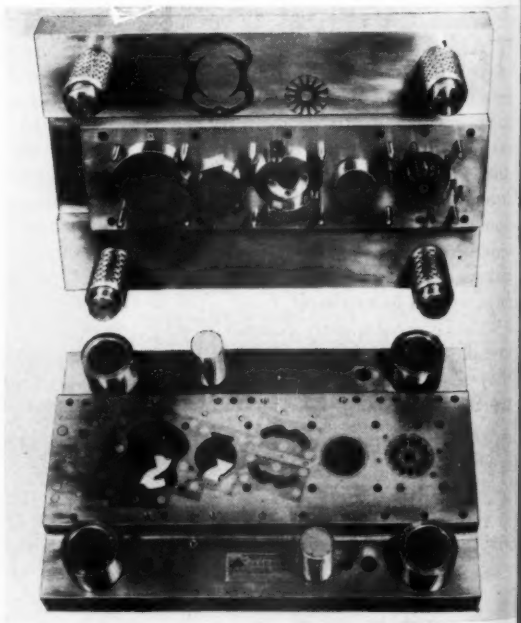
The electronic gaging system used in this operation is also currently being used for automatic gaging and segregating of such diversified parts as valves, valve springs, pistons and piston pins, and ball and roller bearings.

Banko Patent Dedication

PERTAINING TO THE ART OF BUILDING segmented dies, a patent (Re. 24,439) issued to George Banko, President, Cleveland Tool & Die Co., of Cleveland, Ohio, has been dedicated to the public.

Shown here is a segmented, progressive die for blanking electric motor laminations. The Banko patent describes methods of bolting individual interlocking segments of tungsten carbide to the softer metal base. The carbide segments are shaped to the contours to be cut. The patented methods prevent tilting or lateral misalignment of the segments.

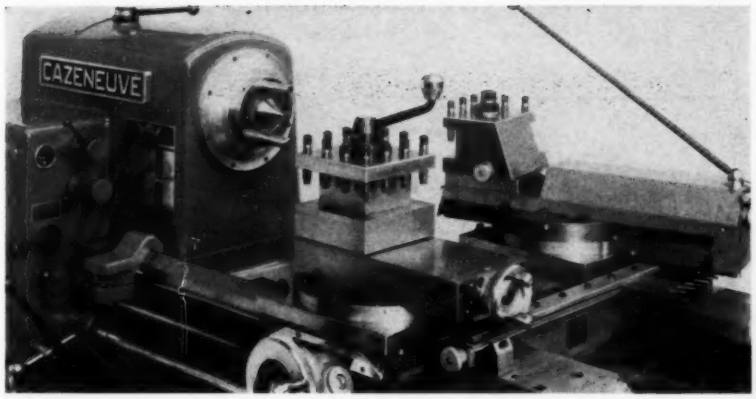
The Banko patent dedication date was June 15, 1959, and the formalities consist of "affixing a red tag to the front of the patent stating that the assignee has relinquished all rights."



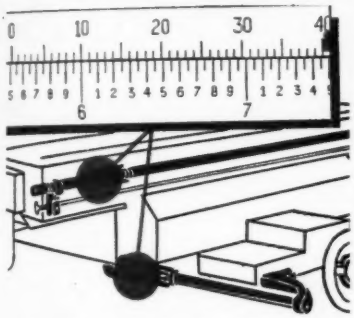
Same Setup For Two Operations

Contour turning and standard lathe operations can be done simultaneously with one setup on the Cazeneuve lathe. The machine, widely used in Europe, has been introduced to this country by the Cazeneuve Sales Co., San Francisco 7, Calif.

Features of the lathe include high horsepower drives, and high spindle speeds (up to 3200 rpm). Unitized spindle construction provides spindle accuracies to less than 0.000050". A unique type of tool post turret construction guarantees tool positioning to less than three microns. For details, circle Inform-A-Gram No. A2.

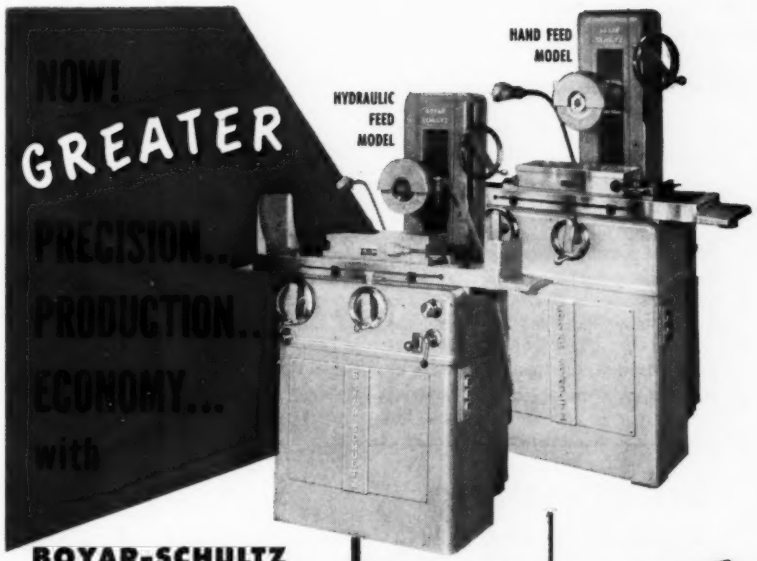


Direct-Reading Machine Verniers



Problems due to backlash, lead screw wear, and miscount of turns are eliminated by the direct-reading Evertrue vernier scales. They can be mounted easily on any precision machine tool and moved from one to another. A portion of the easy-to-read scale is shown "to size." Graduations are SIP engraved and permanently guaranteed for accuracy, says Edgcomb Engineering & Engraving Co., Burbank, Calif.

Unlike lead screws, these scales do not depend on rubbing or mating surfaces, so wear can't destroy their accuracy. Installation is simple. Scales are rotatable for easier reading and protection of faces. Get details, circle A3 on Inform-A-Gram Card.



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Exclusive features include heavy duty precision spindle; vertical column assembly supported by horizontal cylindrical ways; closely grained nickel alloy table with longitudinal ways of hardened and ground tool steel; vertical feed assembly with precision ground worm gear perfectly fitted to bronze gear for easy operation.

Hydraulic operation is accomplished by controls A and B above. These controls automatically disengage longitudinal and cross feed hand wheels.

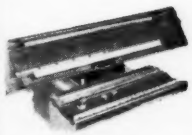

Table ways, one V and one flat are ground and hand scraped. They travel on hardened and ground tool steel ways.

Precision screw on vertical feed assembly turns through a perfectly fitted steel worm and bronze gear, operating in grease packed, sealed gear box.

Unique column assembly combines vertical and cross feed travel. Sturdy vertical column has oversize bearing surfaces. Hardened and ground cylindrical ways provide accurate long wearing surface for cross feed travel.

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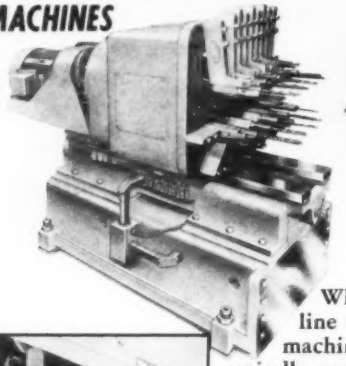

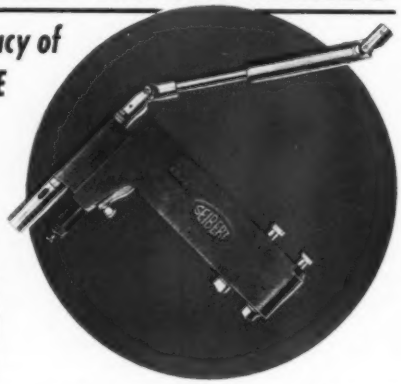

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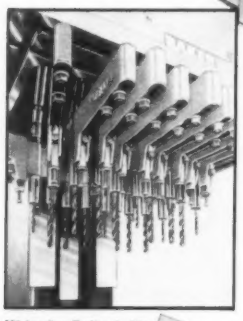

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Pre-production tests at Drillmation Co., Inc., now help companies determine what drilling procedure will be best for particular short or deep hole drilling operations.

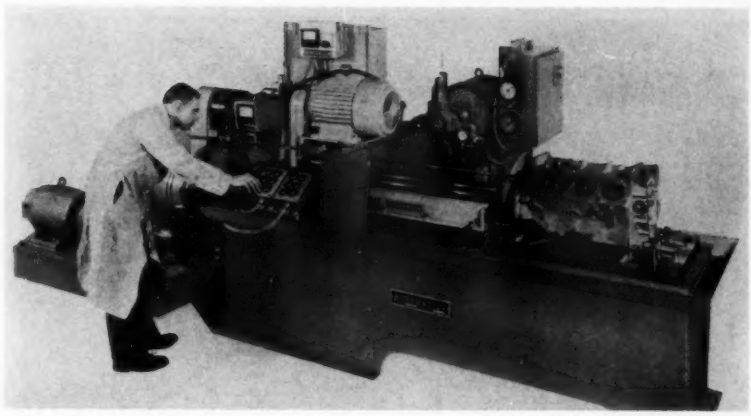
As part of the new service, the workpiece in question is drilled on a Boremation test machine—made up of standard off-the-shelf components and test gages and regulators — that simulates actual production requirements.

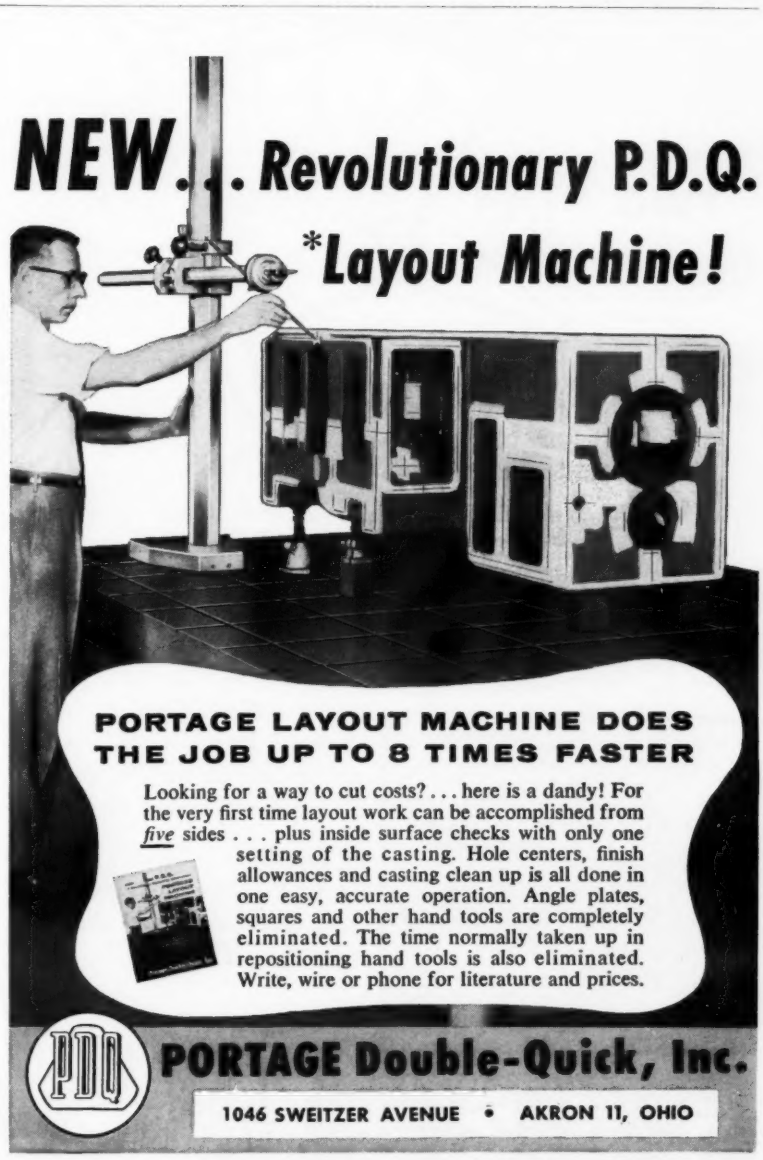
The test machine's power-unit is a standard Boremation way-type Model 2400. It is equipped with a regulated mechanical ball screw feed, driven by a 3/4-hp motor, and can be set to any feed rate from 1/4 to 60 ipm. A feed rate meter makes it possible to pinpoint the optimum feed rate for any drilling problem, no matter what the workpiece material or drill size. Feeds as fine as 0.0001 ipr can be determined and held with the help of this meter.

Spindle speeds are controlled by means of an alternator which has a range of 20 to 100 cycles. The alternator is the power supply that drives a 5-hp variable frequency spindle motor. With this arrangement infinitely variable spindle speeds are obtainable with ranges from 300 rpm, which is needed to drill metals like 300 stainless, up to 10,000 rpm which is the optimum for a finished hole in magnesium.

A load resistance meter, working in unison with the spindle motor, shows changes in the workpiece material, changes in the tool condition, and horse power required to drill a given size and length in a certain time to obtain a required tolerance and finish.

For more information about this service, contact Drillmation Co., Inc., 6500 E. 11-mile Rd., Center Line, Mich., or circle Inform-A-Gram No. A7.

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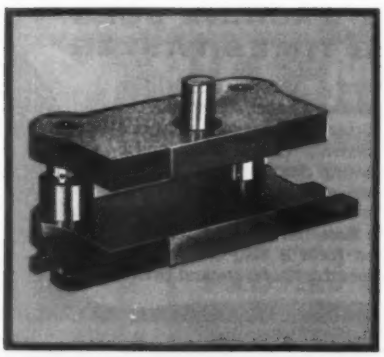

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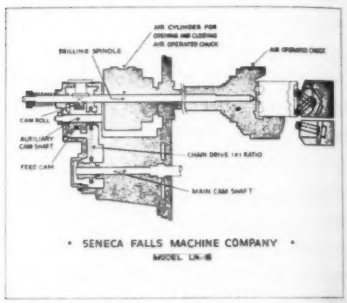
Center Drilling Combined with Boring and Facing

A unique tooling setup enables Cummins Engine Co. to eliminate a separate operation by center drilling aluminum pistons through the spindle while they are being bored, faced, turned, and chamfered. Perfect alignment of center drilling and skirt boring is assured because both operations are done simultaneously in a single holder. The 5-3/16" cast aluminum diesel engine pistons are machined on a Seneca Falls Lo-Swing lathe.



The center drilling operation is done with a cam-driven spring-loaded drilling spindle that's connected directly to the main cam shaft of the lathe. The center drilling spindle is in a retracted position when the part is loaded in the chuck.

When the main cam shaft is engaged to begin machining operations, its rotation is transmitted through a 1:1 ratio chain drive to the auxiliary cam shaft. This, in turn, is translated into linear motion by a cam roller in the feed cam groove, which is keyed into the drilling spindle shaft.

As the feed cam turns, the roller forces the drilling spindle forward, thus machining a center in the piston dome. The drilling spindle is keyed to prevent rotation. When the centering operation is complete the tooling is automatically disengaged and retracted. For details, circle Inform-A-Gram No. A4.

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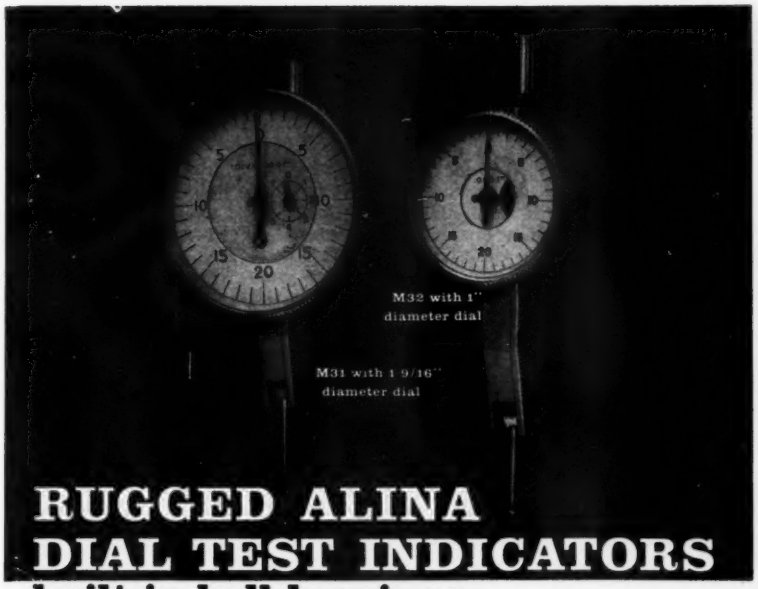

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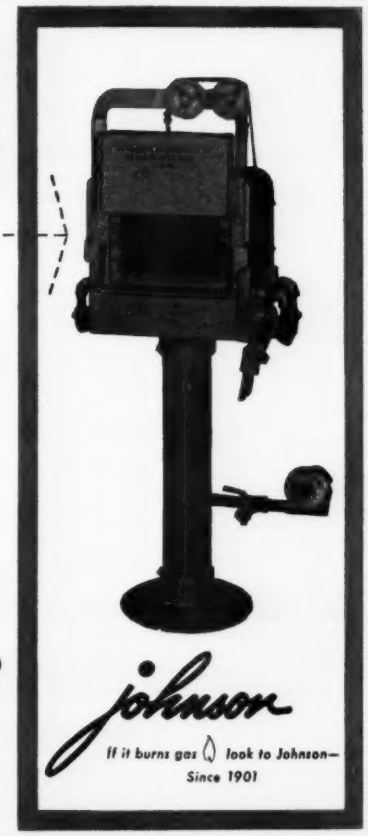

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Catalogs and other helpful literature

A New 68-Page Drill Catalog includes latest information on drills and drilling procedures. Gives data on reconditioning, speeds and feeds, jig drilling, and drilling difficult-to-machine materials. Cogsdill Twist Drill Co., Inc., or Circle No. C1.

Pace Taper Roller Bearing Live Centers are described in a bulletin which lists specifications and features and includes dimensional drawings and information on special spindles. Pace Engineering Co., for Catalog J-52, or Circle No. C2.

This is a MARVEL High-Speed-Edge Hack Saw Blade Cutting a 4" x 4" Titanium Billet

EVERYTHING'S IMPROVED BUT THE GUARANTEE

33 years ago, MARVEL introduced the first welded-edge hack saw blades . . . guaranteed them to be shatterproof . . . and a new concept of power hack sawing came into existence.

In combining, by welding, two materials—a narrow, high speed steel cutting edge, and a tough alloy steel body, MARVEL pioneered the modern hack saw blade.

When operators learned they could apply the heaviest feed pressures and highest speeds to the new MARVEL Blades with complete confidence that they would never shatter or "explode" to cause them personal injury, hack sawing began the approach to its present high level of efficiency. Even cutting "exotic" metals, such as titanium, where heavier feed pressures are a necessity, the MARVEL Blade does an outstanding job and is completely safe.

Today's MARVEL High-Speed-Edge Hack Saw Blades are greatly improved, even over the MARVEL Blades which were the best on the market a few years ago. Advanced metallurgy has produced better steels; new heat treating and manufacturing techniques have brought further improvements. The only thing unchanged is the Guarantee: THEY ARE SHATTERPROOF!

If you haven't used MARVEL High-Speed-Edge Hack Saw Blades recently, try them on your saws for a month and see the difference a truly superior blade can mean in higher speeds, greater accuracy, lower cost per cut, and guaranteed safety to operating personnel. Your nearby MARVEL Distributor carries a complete stock of MARVEL High-Speed-Edge Blades.

Write for Bulletin CT-175 which has complete details on MARVEL High-Speed-Edge Hack Saw Blades.

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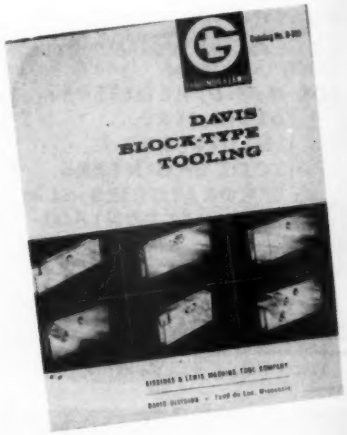
MARVEL Metal Cutting SAWS

CIRCLE INFORM-A-GRAM KEY NO. 82

Carbide-Tipped Saws, knives, and cutters are described in a new 16-page catalog and price list. Lemmon & Snoap Co., or Circle Inform-A-Gram No. C3.

A New Aluminum Machining Chart provides tables of recommended speeds and feeds for different machining operations like forming, turning, drilling, boring, reaming, and cutting-off. A cutting speed conversion table is included. Peter A. Frasse & Co., Inc., or Circle Inform-A-Gram No. C4.

"Block-Type Tooling" describes applications of the interchangeable types of Davis block toolholders and cutting tools, including new throw-away carbide insert type. Get catalog D-510 from Davis Div'n, Giddings & Lewis Machine Tool Co., or Circle No. C5.



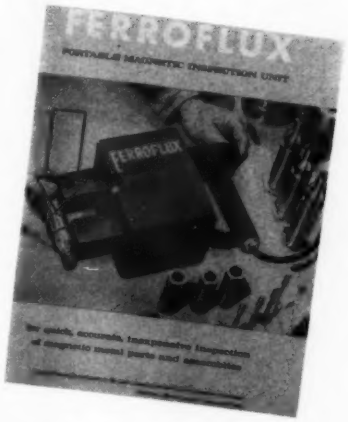
A Handy Tap and Gage Selector Chart lists DoAll tap, tap drill size, and plug and ring gages needed to produce and check classes of thread. Gives N.F., N.E.F., and N. sizes, minimum and maximum limits, and correct item for different jobs. The DoAll Co., or Circle Inform-A-Gram No. C6.

For Locating Small Drills use a Jig Bore Special Kit, featured in a bulletin which also gives dimensions and advantages of groove, taper, cross hole, and concentricity gages. Hawkeye Specialty Co., or Circle Inform-A-Gram No. C7.

Toolholder Bushings, both split and solid, are described in a new data sheet and price list. Gahr Machine Co., or Circle No. C8.

"Air Operated Chucking Equipment" presents a complete listing of the line and typical applications with detailed installation procedures. Write the Cushman Chuck Co., for Bulletin PO-66D, or Circle Inform-A-Gram No. C9.

Catalogs . . .



Locate Invisible Defects in ferrous metal parts and assemblies using the Ferroflux method, described in a bulletin. Detecting equipment, its operation, application, and advantages are described and illustrated. Get Bulletin F-59 from Ferro Machine & Tool Corp., or Circle Inform-A-Gram No. C10.

The Large-Head-Diameter Hex Socket Cap Screws manufactured by The Allen Mfg. Co. are listed in a bulletin. Tables of dimensional standards and comparisons of heat diameter bearing surface and tensile load to indent soft steel are given for Series 60. Bulletin G-25 is available from the company, or Circle Inform-A-Gram No. C11.

A Mechanical Cleaner that removes 92% or more of oil, moisture, and dirt from compressed gas and air lines is described in a catalog. Operation, typical installations, dimensions, and size selection charts for Aridifier are included. Get Catalog 459 from Logan Engineering Co., or Circle Inform-A-Gram No. C12.

A 416-Page Precision Instrument Components Catalog lists over 10,000 items including gears, shafts, collars, couplings, speed reducers, and differentials. Contains technical data and breadboard kit sections. Get Catalog 20 from PIC Design Corp., or Circle Inform-A-Gram No. C13.

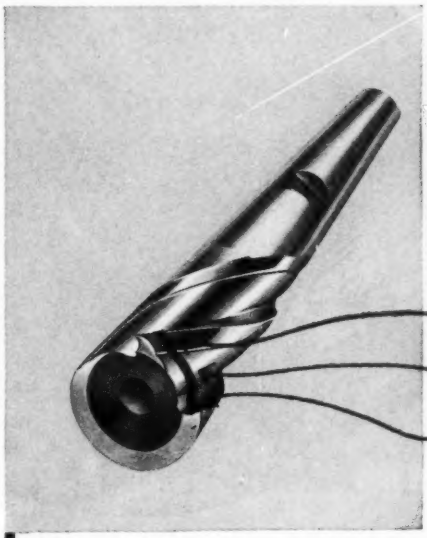
Hardened C-Clamps A C-Clamp Catalog describes features of the complete line and explains the new hardening process which is used on these clamps. They are available with either forged or cast frames, in conventional or rapid action. Write Wilton Tool Mfg. Co., Inc., Schiller Park, Ill., for Catalog 707, or Circle Inform-A-Gram No. C14.

"Special Screw Machine Tools" gives dimensions and describes circular, dovetail, and flat form tools, and cutting cams. Specifications are also given for recessing and forming swing tools and adjustable cross slide knurl holders. Write George L. Detterbeck Co., or Circle Inform-A-Gram No. C15.

"Dimensional Standards for Semi-Tubular Rivets" contains standards data on all major classes of semi-tubular rivets. Body and head diameters, head thicknesses, radii, hole diameter, and depth figures are given. Tubular and Split Rivet Council, or Circle Inform-A-Gram No. C16.

A Two-in-One Vise and V-Block Combination, developed by New Town Machine & Tool Co., Inc., saves planning time. It's made of hardened tool steel, precision ground to 0.0004". Get literature from company, or Circle No. C17.

A New Air-Hardening Steel, Mineor, can be used in place of costlier high-carbon high-chromium steels. Used in applications where easy machinability, non-deforming properties, and simple heat treatment are important, it gives long life and productivity. Darwin & Milner Inc., or Circle No. C18.



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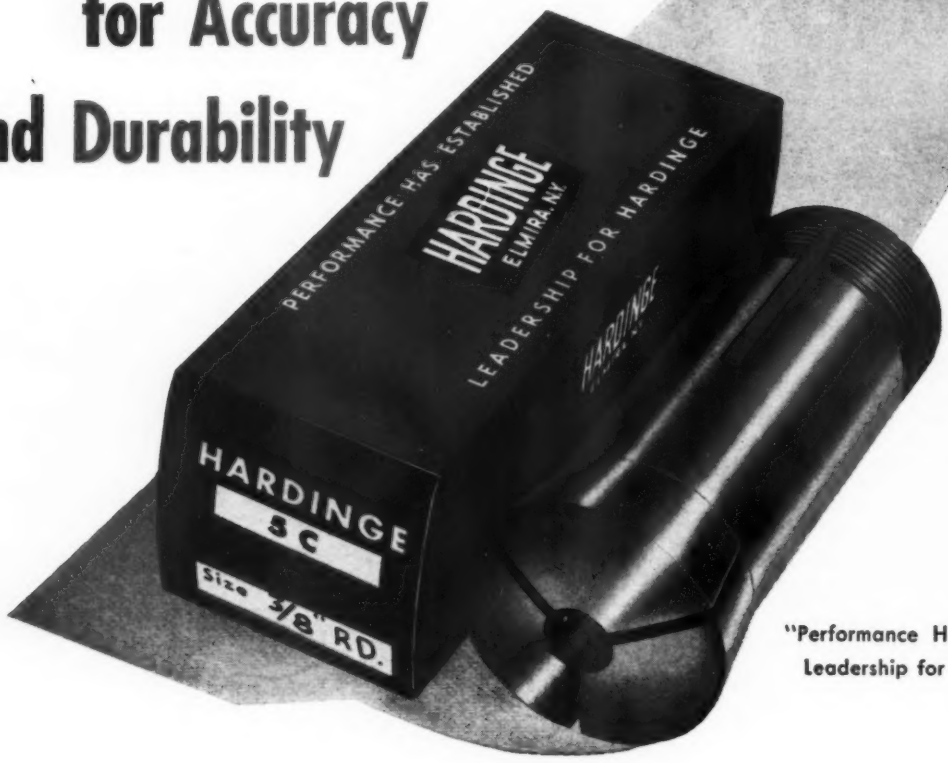

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A1	C11	C29	C47	P14	P32	P50
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7	27	73	812	981	1044	1092	1163
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12	32	83	932	1001	1061	1132	
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16	53	87	942	1021	1065	1141	
17	57	88	951	1022	1071	1142	
19	59	89	952	1023	1072	1143	
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A3	C13	C31	C49	P16	P34	P52
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A5	C15	C33	C51	P18	P36	P54
A6	C16	C34	P1	P19	P37	P55
A7	C17	C35	P2	P20	P38	P56
A8	C18	C36	P3	P21	P39	P57
C1	C19	C37	P4	P22	P40	P58
C2	C20	C38	P5	P23	P41	P59
C3	C21	C39	P6	P24	P42	P60
C4	C22	C40	P7	P25	P43	P61
C5	C23	C41	P8	P26	P44	P62
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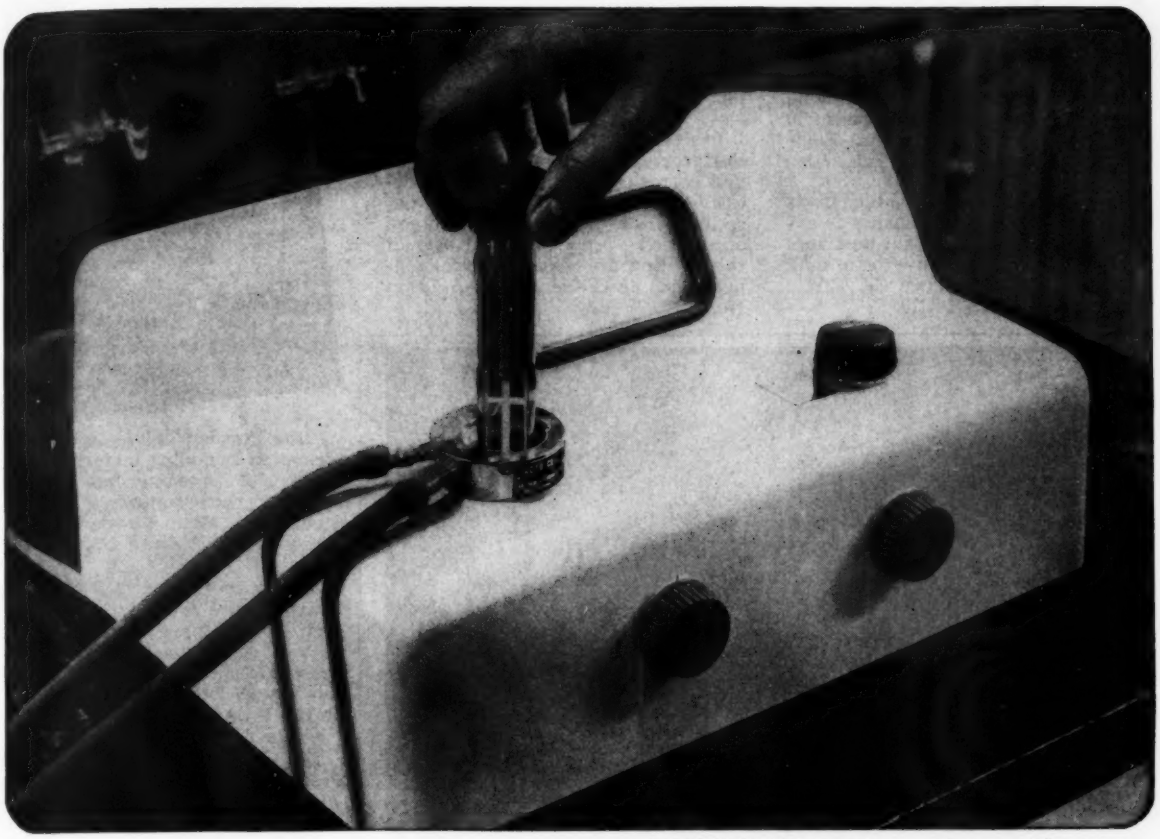
***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



COLORIMETER (inherently extremely accurate) determines percentages of molybdenum, tungsten, cobalt and manganese in A-L tool steel to insure consistent, high quality.

Colorimeter measures exact chemical composition of Allegheny Ludlum tool steel melts

Accurate adjustment of alloys guarantees uniform heat treatment, predictable dimensional changes, reduced grinding, standardized machining operations.

Close control of molybdenum, tungsten, cobalt and manganese is at the heart of a good tool steel melt. In addition to the usual testing methods, Allegheny Ludlum's chemical laboratory checks these metals with Colorimetry because of its inherent, extreme accuracy.

On the basis of the Colorimeter's findings, it is possible to make carefully calculated furnace additions of ferro-alloys, insuring precise control over chemistry. This guarantees your receiving the *exact* analysis order after order, providing *uniformity of heat treatment, predictable dimensional changes, reduced grinding and standardized machining operations.*

Colorimetry is but one step toward careful control over composition. Allegheny Ludlum also sets exacting purchasing specifications on raw materials and scrap. Quality Control checks all incoming orders to see that they conform with these specifications. Another guard toward your getting your exact specifications: each ingot bears a metal tab showing heat number.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. TP-20

WSW-7262

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

CIRCLE INFORM-A-GRAM KEY NO. 85

Catalogs . . .

Precision Jig and Fixture Components listed in bulletin and price list. Gives specifications for clamping pins, spring plungers, toggle pads, fixture keys, and eccentric leveling buttons. Herrmann Engineering & Sales Co., or Circle C19.

How Spinning Cuts Tooling Costs on short runs and odd shapes is explained in a brochure that describes metal spinning and hydro-forming facilities of J. Schrader Co. Circle Inform-A-Gram No. C20.

A 20-Page Attachment and Accessory Catalog offers information on cutter grinders, electro-markers, master index fixtures, cutters, and collets. Explanations and specifications are given. H. P. Preis Engraving Machine Co., or Circle C21.

Protect Metallic and Non-Metallic Surfaces from abrasion, scuffing, and corrosion during in-plant processing with Turco Fabrifilm, described in a bulletin. Advantages, applications, properties, and uses of this coating are given. Turco Products, Inc., or Circle Inform-A-Gram No. C22.

MOLINE
FOR GREATER PRODUCTION EFFICIENCY SAVINGS
Use rugged, reliable "Hole Hog" machine tools for such jobs as:
• Multi-Spindle Boring
• Single and Multi-Spindle Honing
• Straight Line Multi-Drilling
• Adjustable Spindle Drilling
• Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
• Special Multiple Operation Machine Tools
HU110
Universal Joint Type
Driller with 18" x 32" drilling area and 16 spindles having 2" joints, each with 2-speed-and-neutral driver. (Above)
HHU84
Three-Way, 74-Spindle Driller using spindle drive units similar to that on HU110 above, but with slip-type spindles.
★ Over 58 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.
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100 20TH STREET, MOLINE, ILLINOIS
REPRESENTATIVES IN PRINCIPAL CITIES
CIRCLE INFORM-A-GRAM KEY NO. 86

"Iron Powders" gives technical information including materials specifications of iron sinterings, and iron-copper carbon sinterings. Republic Steel Corp., Metal Powder Div'n, or Circle Inform-A-Gram No. C23.

Aluminum-Bronze Forming and Drawing Dies are detailed in a bulletin which gives advantages and physical properties of three grades designed especially for die use. Get Bulletin 96 from Ampco Metal, Inc., or Circle Inform-A-Gram No. C24.

Ten-Ton Hydraulic Unipunch Presses are described in a catalog which gives features and explains components. Different standard punches and die buttons are also detailed. Catalog 1012-1 from Punch Products Corp., or Circle No. C25.

A Weights Chart of ground flat stock gives dimensions and weight/piece of 18", 24", and 36" stock and squares. Marshall Steel Co., or Circle Inform-A-Gram No. C26.

A Revised 70-Page Handbook describes seamless aircraft tubing, carbon and alloy steels. Covers definitions, sizes, tolerances, testing, machining, properties, and heat treating. Technical Handbook A-2 from Ohio Seamless Tube Div'n, Copperweld Steel Co., or Circle Inform-A-Gram No. C27.

"Prealloyed Metal Powders" explains the meaning of prealloyed and lists many types. Typical properties of sintered Vasco steel powders also shown. Powder Metallurgy Dept., Vanadium Alloys Steel Co., or Circle Inform-A-Gram No. C28.

"A New Concept in Automatic Machine Programming, Tape Control" explains this method and compares it with other types. Advantages, operational drawings, explanations of the preparation of the tape, and operation under tape control are included. For Bulletin 176 from Potter & Johnson Co. Circle Inform-A-Gram No. C29.

Catalogs . . .

"Tungsten Carbide Throwaway Inserts" gives a complete range of grades, sizes, and prices for precision ground negative and positive rake, as well as conventional utility ground negative rake types. Multi Metals, Inc., or Circle Inform-A-Gram No. C30.

"Basic Units for Automation" gives information on cam-operated index units now available to designers and builders of special machinery. Specifications and dimensional drawings are included for standard, conveyor type, and special units. Standard Tool & Mfg. Co., or Circle Inform-A-Gram No. C31.

Gun Drilling Facts are presented in a new 16-page manual by The Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio. Use of

gun drills and types, feeds and speeds, and coolant systems are some of the points covered. For a copy write the company, or Circle Inform-A-Gram No. C32.

A 77-Page Booklet on cold drawn stainless steel wire describes general qualities of 27 types of ferritic, austenitic, ferritic-austenitic, and martensitic stainless steels. Tolerances, mechanical and magnetic properties, and specifications are included. Uddeholm Co. of America, or Circle No. C33.

"Production Tips on Precision Borizing with the Heald Model O Unit-Type Bore-Matic" shows 14 different setups to illustrate how various operations can be combined on this machine. Dimensional drawings and applications of the different units are given. The Heald Machine Co., or Circle Inform-A-Gram No. C34.

"Tape Control Positioning" tells how do-it-yourself applications can be accomplished with packaged positioning units offered by J&L. Brochure LO-5902 from Jones & Lamson Machine Co., or Circle Inform-A-Gram No. C35.

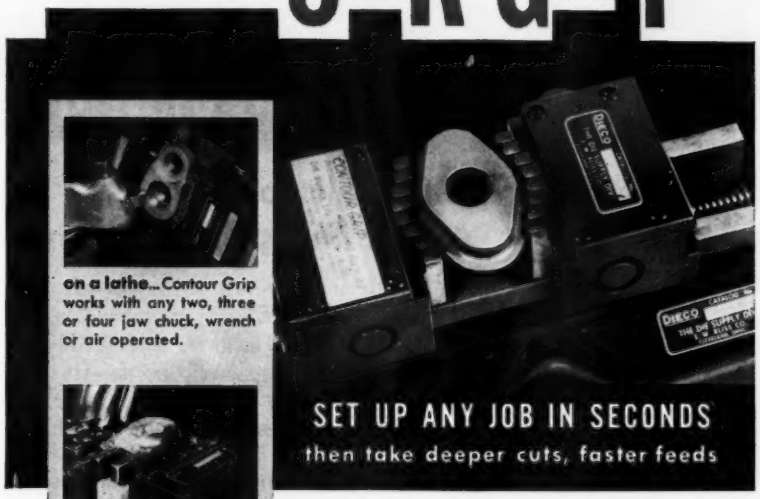
Advantages of Common Language Tape and edge-punched card machines are pointed out in an 8-page booklet. A Synchro-tape typewriter, known as chain reaction automation, produces automatic machine-to-machine processing of paper work from the initial document to final data. Features are given in Booklet RT 8986 from Remington Rand. Circle Inform-A-Gram No. C36.

Increase Working Efficiency for all personnel disturbed by office machine noise by using the accoustical cabinetry described in a bulletin. Gates Accoustinet Co., or Circle Inform-A-Gram No. C37.

Leaded C-1020 Carbon Steel Tubing, for applications requiring high machinability, is described in a data sheet. Comparative machinability ratings for leaded and non-leaded carbon steel are given. For Data Sheet 24, write Superior Tube Co., or Circle No. C38.

New Indexable Insert Face Mills and shell end mills are detailed in a catalog. Cutters with negative and positive rake angles, square shoulder and 45° lead angles, and carbide and high speed steel indexable blades are also discussed. Catalog 591 is compiled by The Viking Tool Co., Circle Inform-A-Gram No. C39.

CONTOUR GRIP



on a lathe... Contour Grip works with any two, three or four jaw chuck, wrench or air operated.

on a milling machine ... Contour Grip makes high speed milling of tough-to-hold parts easy.

on a grinder... this multiple set-up on a Blanchard helped a manufacturer increase his output ten-fold!

Any tool becomes more productive when you use Bliss' new Contour Grip holding fixture; any operator becomes faster.

Contour Grip is a standard fixture that will hold any irregularly shaped part so tightly that you can feed faster and take deeper cuts. It can be used with *any* type of tool, eliminating the need for costly special-purpose jigs and fixtures. And, as picture above shows, your operator can set-up Contour Grip in seconds, then go from piece to piece just by backing off the jaws, dropping the next piece in and tightening up. For long runs or short, it's as simple and as quick as that.

The key to this all-purpose holding fixture's versatility is its individual steel fingers, each of which moves independently as it contacts the work. The fingers mold around the part, and then tighten up *giving greater holding power and a more positive grip than any ordinary fixture can.*

To learn how Contour Grip works and to see the various models available, see your local dealer or contact us direct.

SEND FOR BULLETIN

dieco DIE SETS

E. W. BLISS COMPANY
DIE SUPPLY DIVISION
Cleveland, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 87

Catalogs . .

A Materials Handling Equipment Catalog lists vibrators, hopper level switches, flow control valves, feeders, conveyors, and lapping machines. The 68-page catalog gives descriptions, data, and specifications of all Syntron Co. products. Circle Inform-A-Gram No. C40.

"Screwdriving Tools" gives complete specifications for all sizes of insert bits, bit holders, magnetic bit holders, power bits, hand drivers, and finder sleeve assemblies. Catalog 30-C is available from The Apex Machine & Tool Co. Circle Inform-A-Gram No. C41.

True Trace Hydraulic Tracer Mills, featuring accuracy, speed, and dependability, are discussed in a brochure. Specifications, operational data, and dimensional drawings are included. Get your copy from Famco Machine Co., or Circle Inform-A-Gram No. C42.

Tracer Control Systems for a wide variety of applications are described in a bulletin. Vertical boring mills, skin milling machines, center-drive lathes, turret lathes, and contour profile milling machines are among applications discussed. Contact General Electric Co. for Bulletin GEA-6122, or Circle Inform-A-Gram C43.

Over 114 Standard Boring Bars available from Wesson Co. are described in a bulletin. It gives all specifications for two lines of micro-adjustable and two lines of non-adjustable boring bars, both of which use standard throw-away carbide inserts. Bulletin MB-1158. Circle Inform-A-Gram No. C44.

Wearite Aluminum Bronze Extruded Alloys are listed in a bulletin that gives chemical composition, mechanical and physical properties, and applications. Table of standard extruded sizes available from stock are included. Get bulletin from Penninsular Steel Co. or Inform-A-Gram No. C45.

"Instantaneous Heat" is a 48-page technical bulletin that describes a new luminous wall combustion system for gas-fired, infrared heat treating furnaces. The A. F. Holden Co., or Circle Inform-A-Gram No. C46.

Electro-Safe Punch Presses for increased production of stampings are discussed in a bulletin. Construction features, specifications, and dimensional drawings are given. Kenco Mfg. Co., or Circle Inform-A-Gram No. C47.

A Press Brake Bulletin describes and illustrates standard features, includes dimensional drawings, and gives specifications for 40 standard sizes of Series D press brakes. Capacities from 90 to 500 tons. Dreis & Krump Mfg. Co. Bulletin D-59. Circle Inform-A-Gram No. C48.

"The Pros and Cons of Equipment Leasing for Smaller Manufacturers, Department Stores, and Supermarkets" discusses the cost of leasing compared with outright purchase and purchase through conditional sales contract. Cost charts are included. Foundation for Management Research, or Circle Inform-A-Gram No. C49.

Application of Modern Centralized Lubrication to reduce operating costs and improve production is discussed in "A Report to Management." This 16-page brochure explains advantages over manual methods of greasing and oiling, five practical steps for converting to automatic lubrication. Lincoln Engineering Co., or Circle No. C50.

"Inductosyn, Principles and Applications" is a 32-page bulletin explaining the linear and rotary types of automatic machine tool control systems available for micro-positioning. Farrand Controls, Inc., or Circle Inform-A-Gram No. C51.

TOOLS
FOR INCREASING PRODUCTION

Compact—provides maximum fixture clearance when installed.

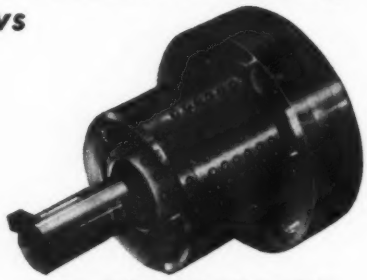
Anti-Friction Arbor Support Bearings

Simple to install—use these anti-friction bearings to INCREASE *arbor rigidity, tool life,* ELIMINATE *chatter,* and REDUCE *maintenance* costs. Only one bearing required for various arbor sizes. Standards for popular makes of milling machines.

ALSO—Free-running pilot bearings and combined linear-rotary motion spindle bearings designed and manufactured to order.

Precision Boring Heads . . . *adjust to TENTHS in SECONDS without loosening or tightening any screws*

Rigid construction and rapid tool adjustment without the use of indicators makes these heads ideal for close tolerance boring. Adjust to .0001 without loosening or tightening any screws—avoiding deflection. Standards and specials.



Size—Positive Adjustment Guaranteed

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BRINEY MFG. CO. 1165 SEBA ROAD • PONTIAC, MICHIGAN
A SUBSIDIARY OF GODDARD & GODDARD CO.

CIRCLE INFORM-A-GRAM KEY NO. 88

Ninety-Three Holes Tapped At One Time

Ninety-three holes in two sides and rear of a tractor transmission case are tapped during each operating cycle of this Model HHU85 three-way horizontal machine announced by Moline Tool Co.

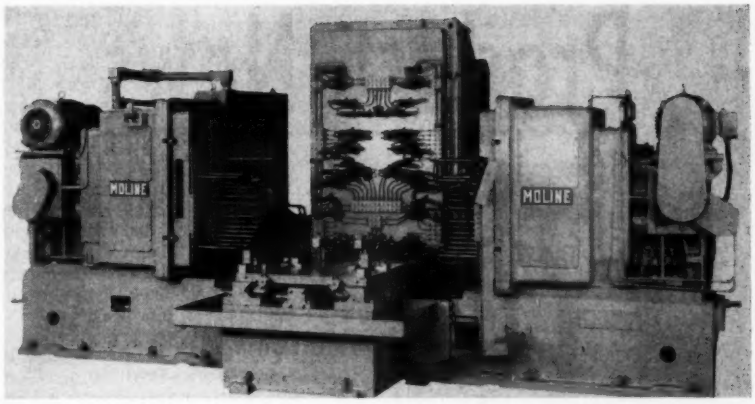
A simple manual clamping arrangement holds part on a hydraulically actuated worktable. The table is moved to the rear against a positive stop into position, and after holes are tapped and taps withdrawn the table is brought forward for unloading.

Each spindle is equipped with individual lead screw feed and each is driven through universal joints and telescoping drive shaft. All are located in accurately bored holes in a slip-spindle plate that easily permits new arrangements of spindle center distances by using different slip-spindle plates.

The left- and right-hand spindle units cover an 18" x 32" working area and carry 23 spindles using ⅜"-16 to ½"-13 taps. The rear unit has a 30" x 54" working area and 47 spindles. Each unit is individually adjustable nearer to or farther from the workpiece.

Spindles are designed to include protection against trouble from tap breakage, partially plugged drilled holes, and absence of drilled holes for taps to enter. A small amount of cutting lubricant is sprayed on each tap automatically just before it enters workpiece. These spindle units are adaptable also to vertical mounting or as transfer machine components. For details, circle Inform-A-Gram No. A5.

THE INFORM - A - GRAM CARD FOLLOWING PAGE 84 IS FOR YOUR CONVENIENCE IN MAKING INQUIRIES.



2741

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HEAVY LIFT...
OR BOTH!

PORTELVATOR®

ENGINEERED POSITIONING EQUIPMENT

- PORTABLE or STATIONARY
- manual or power operation
- ANY KIND or DEGREE of MOVEMENT
- manual or completely automatic controls

★ Portelvator's mechanical power transmission design locks the top-plate by gravity in any attained position. Application of this transmission to multiple elevating screws provides unequalled safety.

IT'S A HAMILTON TOOL USE IT WITH CONFIDENCE

Write for FREE LITERATURE BATCH No. P-801

THE HAMILTON TOOL COMPANY
832 SOUTH NINTH STREET • HAMILTON • OHIO

CIRCLE INFORM-A-GRAM KEY NO. 89

Product News

New Roller Bearing

A New Recirculating Roller-Type Bearing for friction-free linear positioning has been announced by Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8. Tychoway bearings

spread heavy loads over a larger surface and avoid single-point contact that wears or pits easily under high unit pressures. Get details from company, or Circle No. P1.

Porta-Boom Lifter

For Production Handling of odd shaped and bulky pieces use this Porta-Boom on lift trucks. It can also be used to eliminate the rigging of "A" frames and hoists of various types for maintenance. Write to Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich., or Circle No. P2.

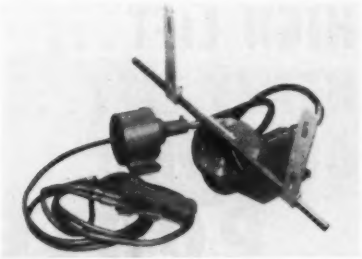
Lift Truck

A New Platform Hi-Lift provides full use of upper cube space in conjunction with storage racks in plants.

Model HPG-40 is ideal for stacking skids and box loads of materials at upper levels, or handling sheet stock. Has 4000 to 6000 lb capacity. Barrett-Cravens Co., 628 Dundee Rd., Northbrook, Ill., or Circle Inform-A-Gram No. P3.

Positioning Unit

A New Work Positioning Combination with finger-tip control enables one man to handle 500-lb workpieces. The air-hydraulic PowRarm 396 consists of a heavy-duty



Wilton hydraulic PowRarm connected to an air-hydraulic booster. Used for heavy assembly work and compound angle drilling. Wilton Tool Mfg. Co., Inc., Schiller Park, Ill., or Circle No. P4.

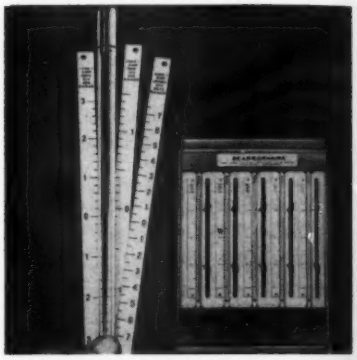
Plier-like Clamp

For Hard-To-Reach Positions, use this new portable plier-type clamp. Model 462 provides swift and simple release in operations where space doesn't permit use of both hands. Available with up to 6" jaw opening and 1200-lb holding pressures. Detroit Stamping Co., 340 Midland Ave., Detroit 3, or Circle Inform-A-Gram No. P5.

Versatile Plate Cams

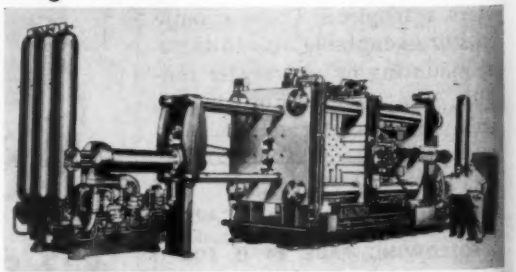
Precision Milled Standard and Semi - Standard Plate Cams have from ¾" to 3" strokes and are designed for use with needle bearing followers of varying diameters that offer a wide range of load capacities. Face (groove) cams are also described in Catalog 900 available from Ferguson Machine Corp. of Indiana, 7818 Maplewood Industrial Court, St. Louis 17, or Circle No. P6.

Tube Converts Amps



Multi-Amp Tube for column-type air gage instruments enables the user to convert from one amplification to another, up to 5000:1, simply by changing calibrated scales. Tube's key feature is its characterized internal configuration which incorporates a predetermined and precisely controlled variant rate of taper. Dearborn Gage Co., Air Gage Div'n., 32330 Ford Rd., Garden City, Mich., or Circle No. P7.

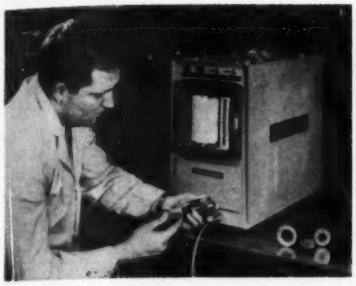
Big Capacity Die Casting Machine



This 2000-Ton Die Casting Machine is for production of extremely large castings. Rugged die toggle mechanism, plus extra heavy platens and tie rods, withstand extreme injection pressures and provide maximum locking pressure to all four corners of the die plate. This Cast-Master, largest of nine standard size cold chamber machines, has a 22" to 36" die stroke, 30" to 44" injection cylinder stroke, and 51" space between tie bars, both vertically and horizontally. Get more information from H-P-M Div'n, Koehring Co., 23901 Aurora Rd., Bedford, Ohio, or Circle Inform-A-Gram No. P8.

Product News

Gage and Record



This Instrument Gages and records simultaneously. It uses hand or fixture-type air gage tooling and makes an automatic record on a 4" wide strip showing a part's plus or minus deviation from nominal size during gaging. The Sheffield Corp., Dayton 1, Ohio, or Circle No. P9.

Transfer Presses

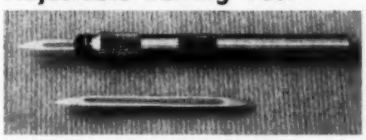
New Transfer Presses are now available in six models from 50- to 150-ton capacities and having from

five to ten tool stations. These Weingarten presses feature quick tool interchangeability and are efficient for small production lots. Get details from Cosa Corp., 405 Lexington Ave., New York 17, or Circle Inform-A-Gram No. P10.

Hardness Tester

Quickly Determine Salt Bath Neutrality to insure accurate control and prevent possible decarburization during neutral hardening, high speed preheat, or high speed hardening of costly alloy steels. Test readings show degree of breakdown from overheating, infiltration of sulphur or alkalies. The A. F. Holden Co., 14341 Shaefer Hwy., Detroit 27, or Circle Inform-A-Gram No. P11.

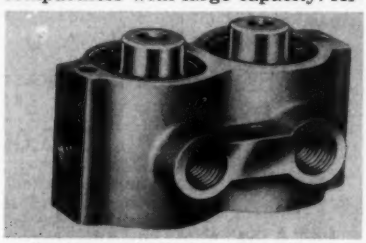
Adjustable Burring Tool



New Adjustable Pocket Scraper and Burring Tool features a cutting blade that's adjustable up to 3" long. Blades are symmetrical on each end so they're reversible. Titan Tool Supply Co., Box L, 1419 Hertel Ave., Buffalo 16, N.Y., or Circle Inform-A-Gram No. P12.

Air Control Valves

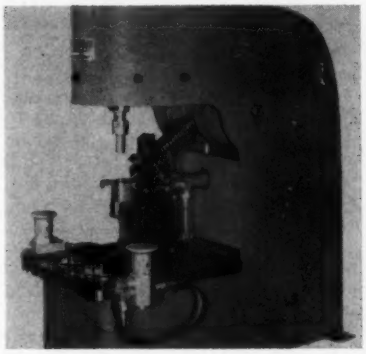
For Automated or Manual Control of Air, gas vacuum, and liquid flow, this new FX line of Humphrey Quick-Dump piloted valves feature compactness with large capacity. Al-



so feature extended service life, positive shut-off, and rapid cycling. Write for bulletin to Humphrey Products Div'n, General Gas Light Co., 202-K3 N. Park St., Kalamazoo, Mich., or Circle No. P13.

Small Parts Feeder

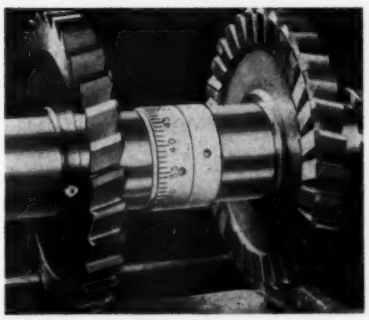
Automatic Feeding of Small Production Parts and convenience of a bench type driver are combined in the new Hopperal driver. The feeder handles screws, nuts, bolts, rivets,



and nails. Can be equipped with solenoid, air, or hydraulic powered driver to drive, peen, press, or stake. Haberstump-Harris, Inc., 10463 Northlawn Ave., Detroit 4, or Circle Inform-A-Gram No. P15.

Adjustable Floor Spacers

Cut Setup Time in half and almost eliminate scrap with newly developed adjustable micrometer arbor spacers, used for straddle milling,

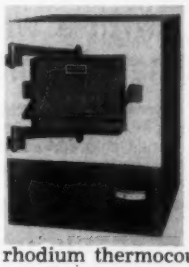


raising blocks, fixture spacers, and stops. They have 0.001" graduations and come in 3/8" to 1½" widths. Mayer Engineering & Mfg. Co., 815 S. 9th St., Milwaukee 4, or Circle Inform-A-Gram No. P16.

Adjustable Center Holding Fixture

Speed Grinding and accurately grind or inspect drills, reamers, counterbores, end mills, and step tools with this new Wetmore adjustable center holding fixture. Simplifies sharpening and backing off of end grinding operations. Work capacity is 6" dia and 16" length. Wetmore Tool & Engineering Co., 5320 E. Washington Blvd., Los Angeles, or Circle P14.

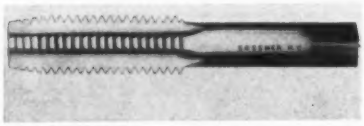
Box-type Furnace



A New Box-Type Lucifer Furnace includes elements with heat ranges to 3190°F. This series comes in box or tube designs and feature automatic controller, platinum-rhodium thermocouple, and magnetic contractor. Write Lucifer Furnaces, Inc., Neshaminy, Pa., for details, or Circle No. P17.

Product News

Durable Taps

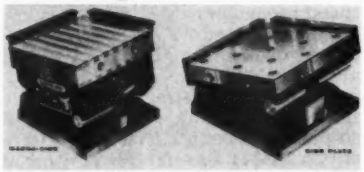


A Triple Temper Process is now applied to all taps manufactured by Sossner Tap & Tool Corp., 29 Broadway, Lynbrook, L.I., N.Y. Triple tempering them increases tap life and reduces incidence of premature breakage and chipping. Details available from the company, or Circle Inform-A-Gram No. P18.

Tempering Furnace

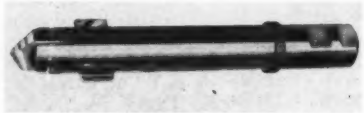
A New General Purpose Furnace is for a wide range of tempering and drawing jobs requiring close temperature control. Type D Flexotemp furnace quickly reaches desired temperature and is uniform to within ±5°F during treatment cycle. C. I. Hayes, Inc., 800 Wellington Ave., Cranston 10, R.I., or Circle Inform-A-Gram No. P19.

Small Magnetic Sine Plate



A New Small Size Magna-Sine and Sine Plate have been announced by The Omer E. Robbins Co., 11961 Dixie Ave., Detroit 39. They come in 4" x 4" working area. Magnetic model has strong, fine pole, permanent magnet chuck that firmly holds small work without distortion. Get data from the company, or Circle Inform-A-Gram No. P20.

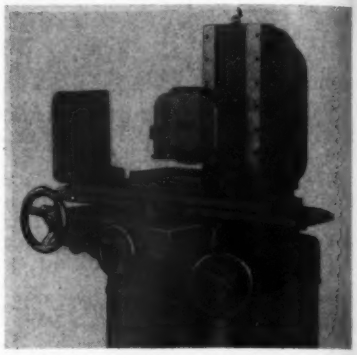
One Stroke Hole



Simultaneously Drill and Finish Holes to size with a single stroke using a new tool. It's especially designed for rapid production of large diameter holes in thick plate. Tool consists of a bar which combines replaceable spade drill with adjustable cutter for reaming the hole to size. Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif., or Circle Inform-A-Gram No. P21.

Surface Grinder

A New Floor Model Hydraulic Surface Grinder features 14" capacity under full 12" dia grinding wheel, and infinitely variable table speeds up to 70 ft/min. Also has infinitely variable cross feed from 0.005" to 0.250", with rapid traverse for dressing the wheel from the chuck or quick positioning the work. Bulletin 179 available from Covel Mfg. Co., Benton Harbor, Mich., or Circle Inform-A-Gram No. P22.



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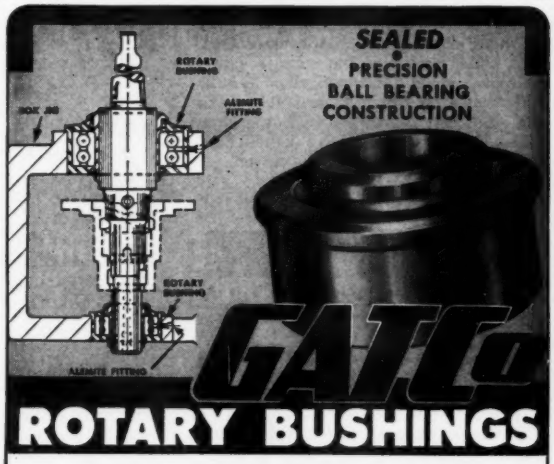

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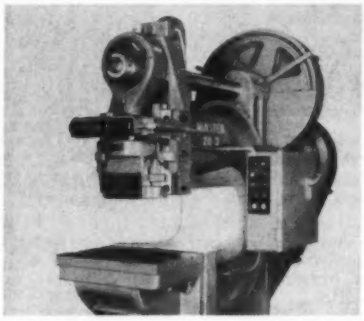
CIRCLE INFORM-A-GRAM KEY NO. 942

Product News

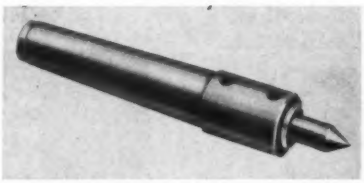
Large-capacity Presses

For Light and Medium Punching, cutting, and flanging on large pieces use the new Series 20 deep throat punch presses introduced by Minster



Machine Co., Minster, Ohio. Features heavy cast iron frame which forms a deep throat that allows punching to the center of a 60" circle. Write the company for more information, or Circle No. P23.

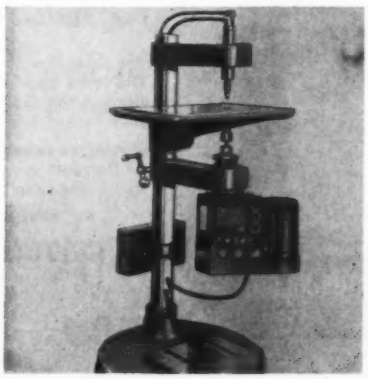
Accurate Dead Center



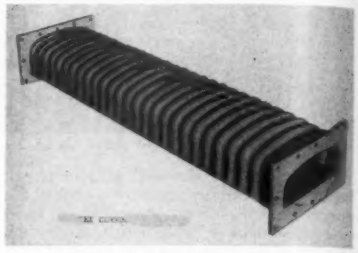
A Spring-Loaded Dead Center of simple, precise construction is not subject to ill effects of thermal expansion of mandrels or workpieces for greater accuracy. The end thrust of the dead center can be adjusted to meet each job requirement. Chemtor Products Co., 32805 Northwestern Hwy., Franklin, Mich., or Circle Inform-A-Gram No. P24.

Circuit Driller

A New Automatic Circuit Drilling Machine, operating from a master template, drills the most complex patterns at 60 or more per minute rate. Features 0 to 2" stroke length, #60 to ⅜" drill capacity, and 400 to 7,420 rpm speed range. Bulletin available from Sullivan Automatic Specialties, Inc., 6705 14th Ave., Kenosha, Wis., or Circle No. P25.



Long Wearing Muffles



Corrugated Muffles assure longer wear and higher temperature resistance. Warping and buckling, common occurences under high temperature, are almost eliminated because of the corrugated design. Come in 12½" x 5" x 57" size and are made with ¼" inconel plate. Wiretex Mfg. Co., Inc., 40 Mason St., Bridgeport 5, Conn., or Circle Inform-A-Gram No. P26.

Floor Model Solderer

A New Automatic Induction Soldering and Brazing Machine is floor-mounted and consists of a Reevelec L4D 1 KW high frequency induction

heating generator and a variable speed motor-driven turntable of 18" or 36" dia. Reeve Electronics, Inc., 609 W. Lake St., Chicago 6, Ill., or Circle Inform-A-Gram No. P27.

ID Multi-Mike

A New Micrometer, permitting internal measurements to 0.0005", has been announced by Navan Products, Inc., 900 N. Sepulveda, El Segundo,

Calif. Multi-Mike measures from 0.050" to 1.050" cylinder groove widths and from 0 to 1" lands and distances between grooves. Write the company for details, or Circle Inform-A-Gram No. P28.

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Just lock Burr-Bit on any make tap and holes are deburred automatically, leaving a smooth clean chamfer. ONE OPERATION, ONE SETUP, ONE HANDLING.

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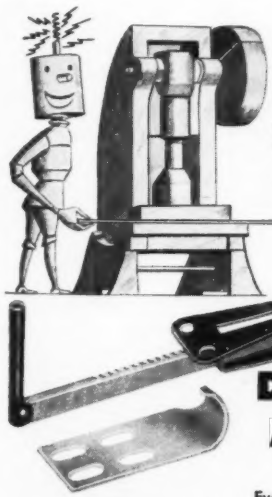

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for punch press dies

$17.75 each

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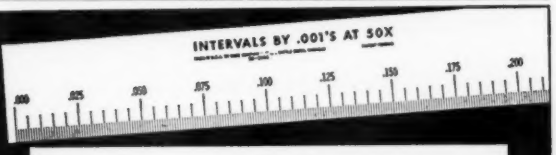

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GAGE COMPANY
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CIRCLE INFORM-A-GRAM KEY NO. 954

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Low cost automatic

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Features:

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- **Standard gear-head motor.**
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- **Demand-control mechanism and wide variety of discharge tracks furnished at modest extra cost.**

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INDUSTRIAL AND AUTOMATION DIVISION
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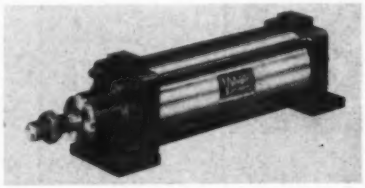
DETROIT 39, MICHIGAN
CIRCLE INFORM-A-GRAM KEY NO. 961

Product News

Rugged Cylinders

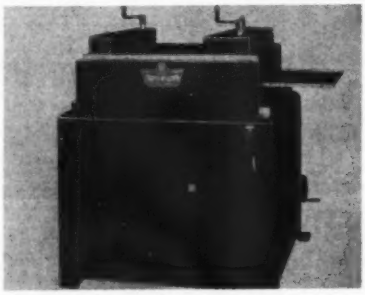
A New Line of Heavy-Duty Air and Hydraulic Cylinders are for use on automated and other high production machinery. Feature extra-



long bronze rod bearing, with length to rod diameter ratios of up to 2:1 to provide maximum rod stability and resistance to side-loading deflection. Valvair Corp., 454 Morgan Ave., Akron 11, Ohio, or Circle Inform-A-Gram No. P29.

Coil Straightener

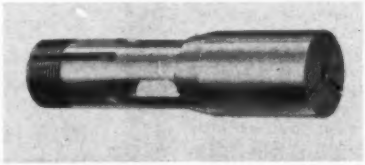
A New High-Accuracy High-Production 20" Parts Straightener reduces expensive hand fitting in assembling and provides improved



performance for functional parts such as clutch discs and backing plates. Accommodates up to 20" wide coil and strip. Cooper Weymouth, Inc., 603 Honeyspot Rd., Stratford, Conn., or Circle No. P30.

New Collets

For a Collet for Internal Holding Operations, use the two types developed by The Wade Tool Co., Waltham, Mass. Model 8U-155 holds



workpieces as small as 1/8" dia; Model 8U-165 makes use of interchangeable expanding collets for different sizes, takes larger work, and holds exact shoulder lengths. For details, write the company, or Circle Inform-A-Gram No. P31.

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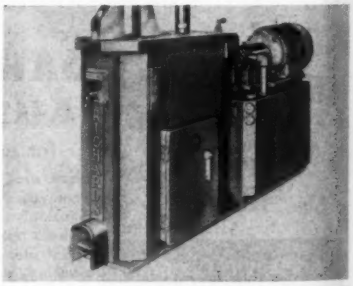
Rapid Finger-Tip Adjustment for depth of cut is instantly made on the Schrillo Micro-Stop countersink by retracting the thimble and rotating to any desired position. When released, precise machine-cut serrations provide positive locking. Final cut is accurate within ±0.001". Get catalog from Schrillo Aero Tool Engineering Co., Dept. 459, 8715 Melrose Ave., Los Angeles 46, or Circle Inform-A-Gram No. P32.

New Bending Machines



A Multiform Hydraulic Bending Machine Line has one machine, Model BB-14, that handles bends on stock up to ⅜" x 6"; another, Model BB-C, will bend ½" x 8" copper. Model BB-H is capable of speeds from inching through 21 strokes/min. The J. A. Richards Co., 903 N. Pitcher St., Kalamazoo, Mich., or Circle Inform-A-Gram No. P33.

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You don't have to "baby" an AIR-MITE Press because they're ruggedly built to stand the gaff of production work. From the tip of their solid steel column to the heavy base, they're every inch a workhorse tool. Feature-for-feature, you can't buy a better, more economical operating press than an AIR-MITE.

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New 3 Way Control Valve. For safer, more efficient press work, use AIR-MITE Control Valves. Connected in parallel and positioned on either side of an air press, they provide a safe, instantaneous press operating control. Operator must depress both handles to actuate press . . . keeps attention on work-piece, hands out of the way. For pressures up to 160 p.s.i.

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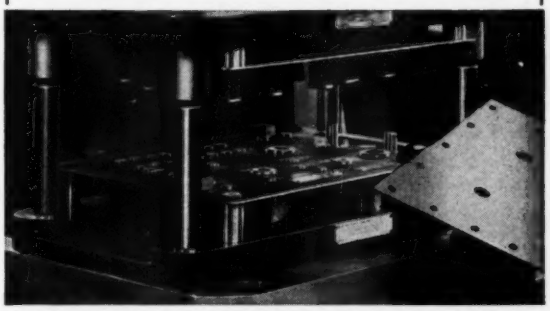

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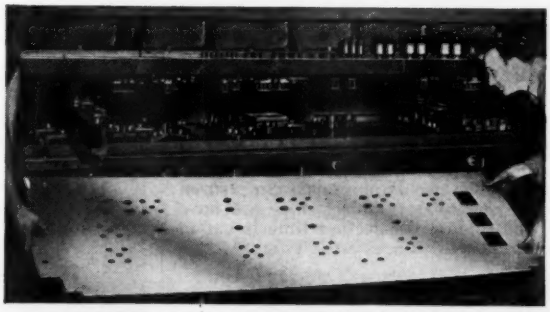

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CIRCLE INFORM-A-GRAM KEY NO. 973

M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

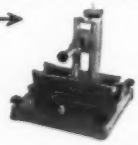
with new Gaertner Coordinate Cathetometers

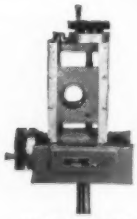
These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.





M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

Write for Bulletin 188-53 & 194-57

The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

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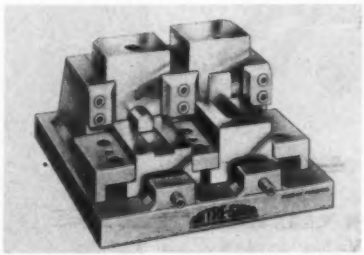
Product News

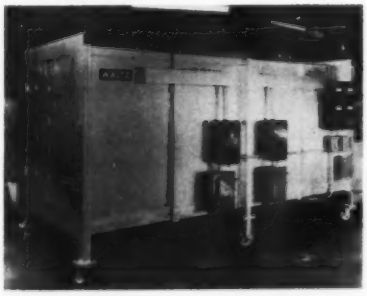
Mitre Tool

Mitre Both Round and Square Tubing, including preformed shapes, easily and cheaply with Mitre-Snug. It produces close-fitting true-mitre



joints that can be brazed or induction welded without need of filing or deburring. Details available from Vogel Tool & Die Corp., 1825 N. 32nd Ave., Stone Park, Ill., or Circle Inform-A-Gram No. P34.

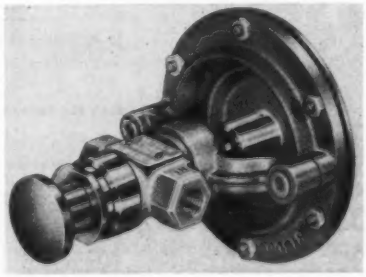
Electric Oven



Preheat Aluminum Sheets in this mobile electric oven featuring roller hearth and generous working space of 12½′ x 4′ x 4′. It uses 440 volt, three-phase alternating current and produces up to 750°F temperatures. Waltz Furnace Co., Dept. 26, 1901 Symmes St., Cincinnati 6, Ohio, or Circle Inform-A-Gram No. P35.

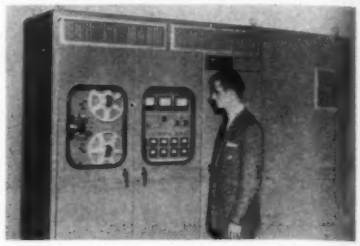
Control Valves

An Auto-Manual Control Valve Line is designed for automatic interlocking of manually-controlled circuits or to permit manual operation of an automatically-operated system. For use in air, oil, or vacuum service and are available with two-, three-, or four-way valve bodies. Valvair Corp., 454 Morgan Ave., Akron 11, Ohio, supplies Bulletin D-58, or Circle Inform-A-Gram No. P36.



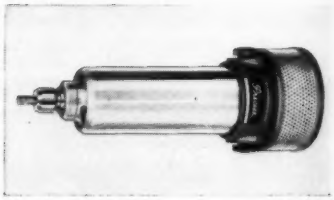
Machines Intricate Parts

A New Bendix Machine Control Unit controls table rotation and machine axes to permit accurate numerical control machining of intricate part shapes. Provides three out



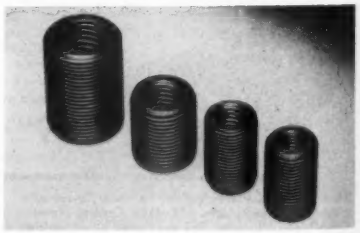
of four axis control of four-axis milling machines and also can switch from a linear motion to rotary table or tilting spindle. Bendix Industrial Controls Section, Bendix Aviation Corp., 21820 Wyoming Ave., Detroit 37, or Circle Inform-A-Gram No. P37.

Easy-to-Use Quill



A New High Speed Power Quill is a self-contained unit with motor and drive designed as a single easy-to-use and easy-to-mount machine tool. Model Super 70 has ⅜" collet capacity and offers load speeds from 15,000 to 35,000 rpm, with a ¾-hp motor. For data, write Precise Products Corp., Racine, Wis., or Circle Inform-A-Gram No. P38.

Bolster Plate Bushings



Simplify and Speed Repairs using the new bolster plate bushings announced by Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10. To beat an emergency, simply retap bolster plate hole and insert threaded bushing to match. Get details from the company, or Circle P39.

ANNOUNCING

The new **CRATEX**

TOOL & DIE MAKERS KIT

The world's finest rubberized abrasives for deburring, smoothing and polishing tools, dies, patterns, molds, models, instruments and component parts.

Kit contains 80 wheels and points in the most popular sizes and shapes, equally assorted in four grit textures, coarse (C), medium (M), fine (F), extra fine (XF)... plus four mandrels for ⅛" chuck... packaged in plastic box, compartmented for fast selection. $7.50 complete.

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DONT GAMBLE

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JIG AND FIXTURE COMPONENTS

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SAVE 50%

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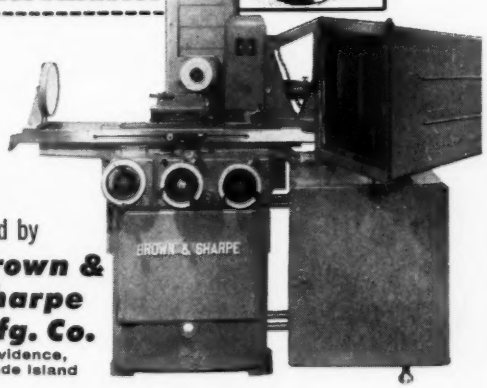
CONTOUR GRINDING COSTS with Micromaster

VISUAL GRIND



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Brown & Sharpe Mfg. Co.

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Visual Grind is manufactured by

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Severance

ECARNO-MILLS

THE ECONOMY MILL NEW DESIGN NEW CARBIDE

Make your money count! Replace more H.S. Rotaries and Mounted Grinding Points.

SOLID CARBIDE CUTTING HEADS

22 Shapes and Sizes Available

A NEW LOW PRICED HIGH CLASS PERFORMER

Made by the originator of ground-from-the-solid Rotary Files, and pioneer in this type of Carbide Mill, who presently offer the largest range of standard types, shapes, and sizes.

YOUR SPECIAL DEBURRING PROBLEMS ARE SOLICITED

OPERATE EFFICIENTLY AT USUAL CARBIDE SPEEDS, YET PERFORM BEAUTIFULLY AT THE SLOWER SPEEDS OF STEEL CUTTERS

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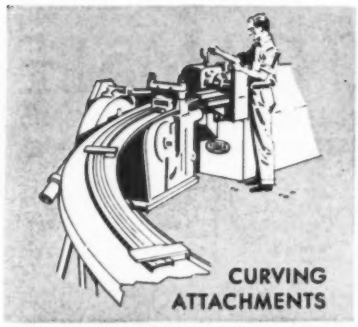

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COLD ROLL-FORMING
EQUIPMENT

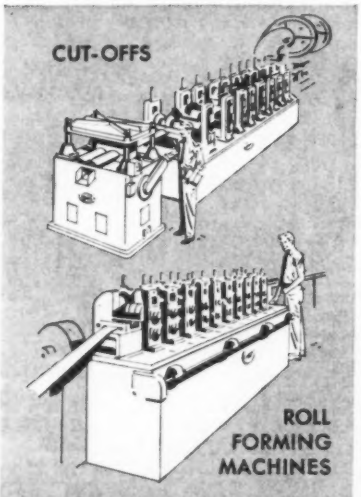
for profitable mass production

High speed, YODER Cold Roll-Forming machines are the most economical method for mass producing structural or ornamental shapes. One machine with one operator can form up to 40,000 feet of shapes per day. Even on a part-time basis, a YODER Cold Roll-Forming machine can prove to be a profitable investment.

YODER flexibility works for you too, curving, coiling, ring forming, multiple roll-forming and embossing—on a wide variety of metals—can be incorporated into your production line. Practical, YODER-engineered design minimizes maintenance and downtime... assures uniformity, accuracy and reliability of your end product.

In addition to Roll-Forming machinery, YODER also makes a full line of Rotary Slitting equipment, Pipe and Tube mills. Send for the fully descriptive Cold Roll-Forming Book.

THE YODER COMPANY
5501 Walworth Ave. • Cleveland 2, Ohio



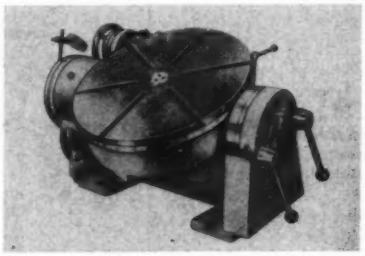
ENGINEERING YODER MANUFACTURING
COLD ROLL
FORMING
MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 1001

Product News

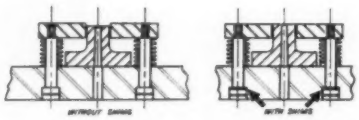
Index Tables

High-Precision Inclinable Tables, used for jig boring, assembly, and inspection are available in six sizes from 10" to 32" dia. They read in 1



or 2 sec, and a circumferential correction cam vouches for 10 sec of arc indexing accuracy. For information, write Opto-Metric Tools, Inc., 137 Varick St., New York 13, or Circle No. P40.

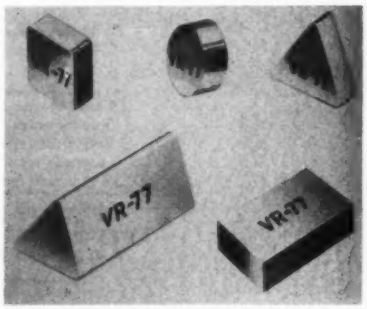
New Shims



Ajust Die Stripper Bolts or shoulder screws using the lengthening and shortening shims announced by Detroit Stamping Co., 340 Midland Ave., Detroit 3. After grinding, shimming, or repairing dies, the insertion of one or more shims establishes correct stripper plate heights in seconds. Get Bulletin 59 from the company, or Circle Inform-A-Gram No. P41.

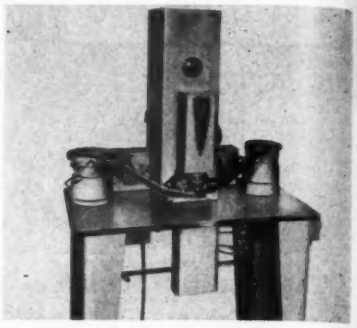
New Carbide Sizes

Thirty-Four New Sizes of VR-77 carbide have been announced by Vascoloy-Ramet Corp., Waukegan, Ill. Excellent shock resistance and



very high resistance to deformation by heat make them ideal for tough cutting jobs. Write the company for information, or Circle Inform-A-Gram No. P42.

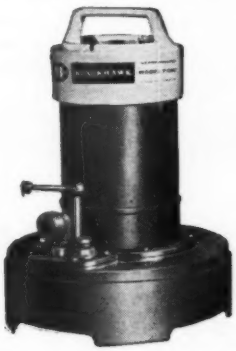
Small Parts Inserter



Insert up to 3000 pcs/hr with this Sertomat automatic inserting machine for small parts such as terminals, connectors, pins, and studs. Parts are fed from two hoppers through chutes and pressed into place by a cam-operated ram which is easily adjustable for pressing force, speed, and stroke. Hill Machine Co., 1301 Eddy Ave., Rockford, Ill., or Circle No. P43.

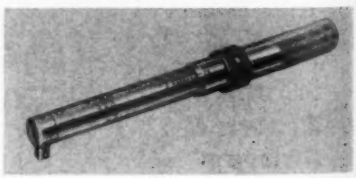
Hydraulic Pump

A Portable, High Pressure Oil-Hydraulic Power Package incorporates a hi-lo circuit and is rated at 10,000 psi. Model P.550 two-speed hydraulic pump combines motor,



pump, reservoir, and valves in one unit and its displacement type pump has four axial pistons. Blackhawk Mfg. Co., Dept. MP, 5325 W. Rogers St., Milwaukee 46, or Circle Inform-A-Gram No. P44.

No Torque Guessing



This Torque Tool clicks at the desired torque, eliminating glancing at dials and scales. After release, it automatically resets itself. Micro-Set measures torque in both left and right directions without adapters. Apco Mossberg Co., 1006 Lamb St., Attleboro, Mass., or Circle No. P45.

Mahr 50 Millionths Reading Mahr

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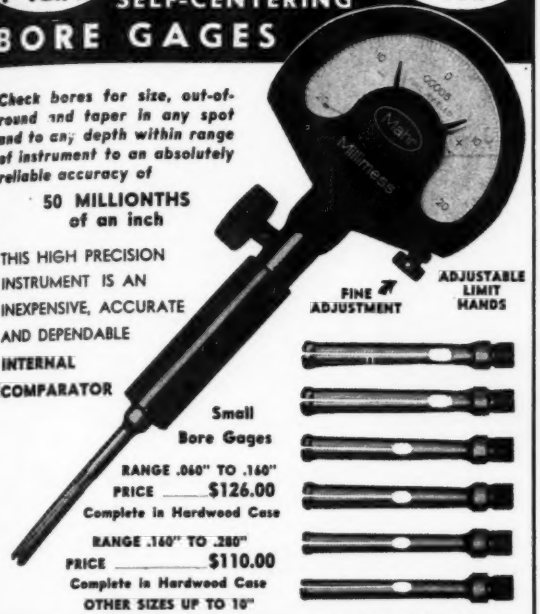
BORE GAGES

Check bores for size, out-of-round and taper in any spot and to any depth within range of instrument to an absolutely reliable accuracy of

50 MILLIONTHS of an inch

THIS HIGH PRECISION INSTRUMENT IS AN INEXPENSIVE, ACCURATE AND DEPENDABLE INTERNAL COMPARATOR



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RANGE .060" TO .160"
PRICE $126.00
Complete in Hardwood Case

RANGE .160" TO .280"
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Complete in Hardwood Case

OTHER SIZES UP TO 10"

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IF NOT AVAILABLE AT YOUR FAVORITE SUPPLY HOUSE — WRITE TO US FOR ILLUSTRATED FOLDER.

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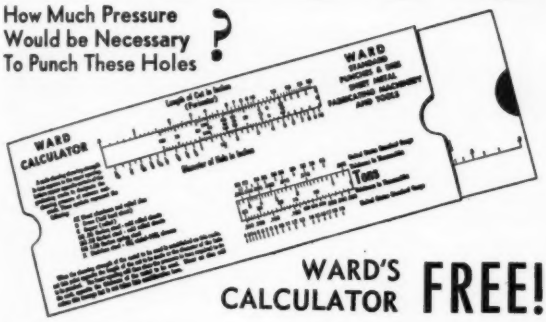
CIRCLE INFORM-A-GRAM KEY NO. 1011

How Much Pressure Would be Necessary To Punch These Holes ?



WARD'S CALCULATOR FREE!

With Ward's Calculator you can easily determine the required ton-pressure for piercing a given size hole (from 3/16" to 10" in diameter and .5" to 30" perimeter) in any thickness and type of metal. A valuable aid for punch and die work. A simple shift of the sliding scale gives an accurate answer in the matter of **seconds—WITHOUT ANY FIGURING.**

Send for your Calculator today! It's absolutely FREE. Nothing to buy. No obligation of any kind.

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WARD Machinery Co. 564 West Washington Chicago 6

CIRCLE INFORM-A-GRAM KEY NO. 1012

what price quality?

What is the lowest cost for dies that can turn out millions of precision-tolerance pieces without retooling?

We modestly suggest one way to be sure of having a valid answer: **include Cleveland Tool and Die Company when you ask for quotations on your next job.**

CTD **specializes** in precision dies. Has for 20 years. For applications ranging from home appliances to atomic reactors . . . from cigarette machines to satellites. More than just a catchword, precision is the basic concept on which our company was founded.

What price quality? Send your prints and specs for prompt quotations. Why not mail them today?

Incidentally, we've prepared a little brochure for your files, telling the CTD quality story, and listing our facilities. Write to . . .

George Banko
President

CLEVELAND TOOL & DIE CO.
1730 Eddy Road • Cleveland, Ohio

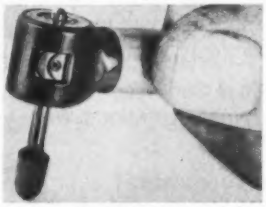
P. S. We also design and manufacture jigs, fixtures, gages, precision components and sub assemblies . . . and do custom grinding, boring and stamping. All to the highest quality standards.

CIRCLE INFORM-A-GRAM KEY NO. 1013

Tomco INC.
HAND WHEELS
Straight Type
Offset Type
SPECIALS
• HAND KNOBS
• MACHINE HANDLES
• HANDLES
• BALL HANDLES
• LEVERS
• SPECIALTIES
GRADUATED DIALS
SPECIFY TOMCO FOR DEPENDABILITY
A Complete line of high grade hand knobs, levers, handles, hand wheels, graduated dials is available for immediate shipment from stock of standard items. Specialty items made to your specifications.
WRITE FOR INFORMATION
Tomco INC.
RACINE 2, WIS.
CIRCLE INFORM-A-GRAM KEY NO. 1021

Airburr

miniature high speed deburring and finishing tool



Here is a small, light rotary tool for deburring and light grinding in tight places. Speeds from 30,000 to 150,000 rpm allow small wheels and burrs to operate at correct surface speeds. Operates on air pressures from 10 to 100 lb/sq. in. with low air consumption.

If your dealer cannot supply you write us for further information.

ELLISON ENGINEERING CO.
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Glendale 4, California

CIRCLE INFORM-A-GRAM KEY NO. 1022

HOLES

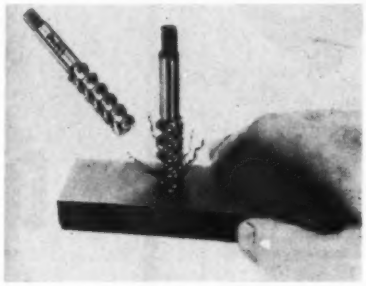
ECONOMICAL
FAST DRILLING
IN DEEP HOLES
Clark "SPADE DRILL"
P. O. BOX 990 BEVERLY HILLS, CALIF.

CIRCLE INFORM-A-GRAM KEY NO. 1023

Product News

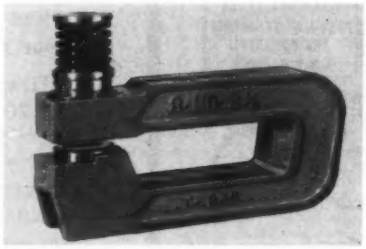
Spiral Tap

Extended Life, greater accuracy, and accelerated chip removal are achieved using the new Hy-Spiral tap announced by The DoAll Co., Des Plaines, Ill. Features 52° spiral



to provide high shear at the cutting point and uninterrupted chip ejection. Has 10°-12° face hook and 2 and 2½ thread chamfer. Write company for information, or Circle Inform-A-Gram No. P46.

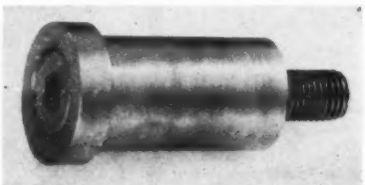
Unitized Tooling



Perforate Various Materials, up to ¼" mild steel, with a new heavy-duty line of Unitized tooling. Series HD features alloy steel holder, built-in lubrication, and easily removable punch and die. Literature is available from Tool Products Corp., 377 Old Falls Blvd., N. Tonawanda, N.Y., or Circle Inform-A-Gram No. P47.

Reduce Die Failure

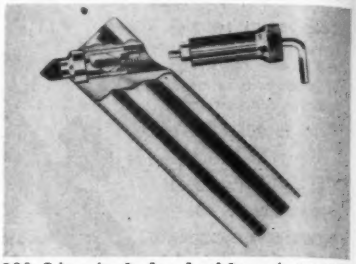
A New Type Die Pad Retainer Spool reduces die and pad failures during production by strengthening the junction between pad and die



shoe. It has greater tensile strength than shoulder screws normally used for this purpose. Literature available from Jolico Industries, 6345 Balfour Ave., Allen Park, 10, Mich., or Circle Inform-A-Gram No. P48.

Boring Cartridges

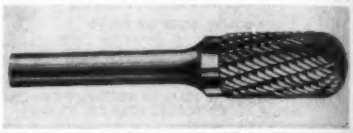
Sure-Bore Micrometrically Adjustable Boring Cartridges are now being stocked by Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8. They come in two types, 53° and



90°. Line includes double-point units, single-point boring heads, and single-point boring bars. For information write the company, or Circle Inform-A-Gram No. P49.

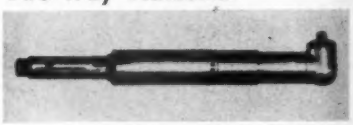
Heavy Duty Cutter

This New Carbide Cutter in Standard Cut and alternate diamond pattern design is for cleaning and finishing operations on castings,



forgings, molds, and dies. Especially effective where metal removal is heavy and time is important. Contact M. A. Ford Mfg. Co., Inc., 1545 Rockingham Rd., Davenport, Iowa, for details, or Circle Inform-A-Gram No. P50.

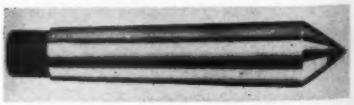
Two-Way Nutsetter



A New Right Angle Nutsetter weighs just over 5 lbs and features automatic torque control and shut-off. Model 14 ANS is practically free of torque reaction and converts easily to a two-way tool. Cleco Air Tools, Houston, Texas, or Circle Inform-A-Gram No. P51.

Alloy-Body Carbide Centers

New Line of Carbide Centers and half centers for lathes and grinders features alloy steel body with Rockwell C hardness of 60 and mirror

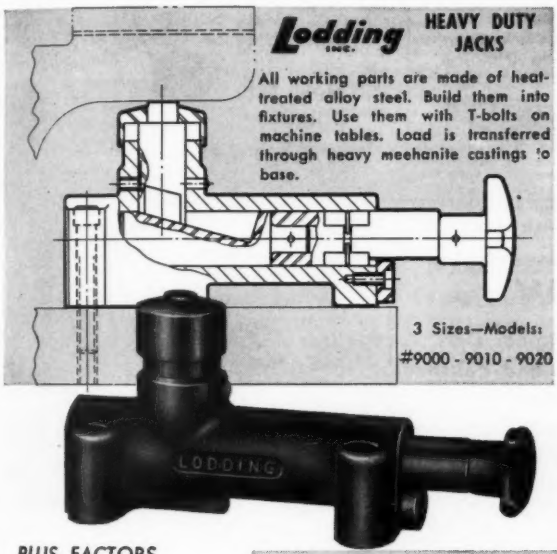


finish, precision lapped carbide point. Extra long inserts permit innumerable regrinds. Choice of tapers offered. Details and prices available from Benco Collet Manufacturing Co., Cleveland 14, Ohio, or Circle Inform-A-Gram No. P52.

PREFERRED

because it ...SAVES MONEY ...SAVES TIME

The acknowledged leader in its field, LODDING appreciates the recognition and commendation it has received from the nation's outstanding tool engineers.


Lodding INC.
HEAVY DUTY JACKS
All working parts are made of heat-treated alloy steel. Build them into fixtures. Use them with T-bolts on machine tables. Load is transferred through heavy meehanite castings to base.
3 Sizes—Models:
#9000 - 9010 - 9020
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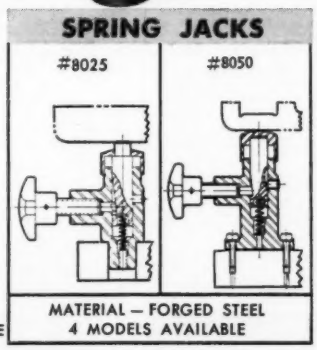
PLUS FACTORS

- ✓ Longer life
- ✓ Greater serviceability
- ✓ All moving parts are heat treated and ground
- ✓ Forged tool steel material

TRACING TEMPLATES AVAILABLE
For information write



Lodding INC.
AUBURN, MASSACHUSETTS

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Goodwin-Snader Co. 6814 S. Western Ave. Los Angeles 47, Calif. PLeasant 3-1553	Bagby Engineering Co. 1047 Forest Ave. Evanston, Ill. AMbassador 2-2273	Southern Tool Dist. Co. 54 11th St. No. East Atlanta 9, Ga. TRinity 5-7065

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by CHICAGO TOOL AND ENGINEERING CO.
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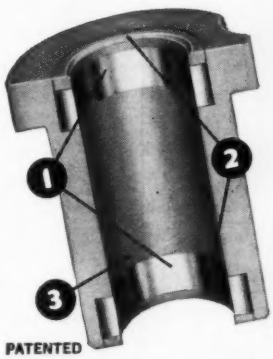
CIRCLE INFORM-A-GRAM KEY NO. 1032

Does the Job of Solid Carbide ...COSTS LESS!



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

There in a nut shell is the story of MEYCO carbide inserted drill jig bushings! Does everything a solid carbide bushing will do at less cost: lasts almost as long; increases life of drills and jigs; greater accuracy—longer; saves man-hours and machine down-time! All this spells high production at a lower cost. For over a decade, carbide inserted drill jig bushings have been saving money on long production runs for cost conscious customers.

Write for full details—
ask for new Bushing Catalog No. 41

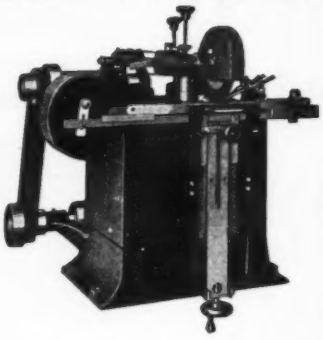
W. F. MEYERS CO., INC., BEDFORD, IND.

CIRCLE INFORM-A-GRAM KEY NO. 1033

For Only a Few Pennies

You can sharpen a gross of Hack Saw Blades with Wardwell's "EC" Combination Grinder. When you have done this only six times you have saved the cost of the machine.

The Wardwell "EC" is the **only** grinder that does not depend upon shape of grinding wheel to form shape of teeth.



WARDWELL
3809 Ridge Road
Cleveland 9, Ohio

For full information about the "EC" Combination, write now.

CIRCLE INFORM-A-GRAM KEY NO. 1041

NON-ROTATING SPINDLE BLADE TYPE MICROMETERS

For Measuring of narrow depth grooves, slots, keyways, splines, square threads, recesses and similar "hard-to-measure" surfaces.

Minute micrometer movements without damage to fragile surfaces

Available Carbide-tipped

BLADE THICKNESS .030" GAGING DEPTHS TO ¼"

Spindle and Anvil Blades are hardened, ground and lapped to contact fit

Graduated in .001" Ranges: 0-1", 1-2", 1½-2½", 2½-3½", 3½-4½" and others

Sold thru Tool Supply Houses

NON-ROTATING SPINDLE BLADE TYPE MICROMETER HEAD

...to be built into fixtures, machine tools, delicate instruments and cross-slides.

WRITE FOR ILLUSTRATED FOLDER Code-GIPUX

GEORGE SCHERR CO., INC.

WEST COAST BRANCH: SCHERR-TUMICO CO. - 3337 W. Olympic Blvd. - Los Angeles 19, Cal.

200-T LAFAYETTE STREET • NEW YORK 12, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1042

Rx FOR INTERNAL INSPECTION

● **0.10" AND UP** . . . That's the point of entry requirement . . . to provide your inspectors the chance to use the outstanding National Fontar Borescope and thus give them the brightest, distortion-free, close-up view of the defect in "inaccessible" interior surfaces of the cast, drawn, welded or molded product . . . from inches deep to many feet.

Find out how its use can be a time and cost saver while it up-grades your Quality Control. Just send for our "Borescope Catalog."

ENGELHARD INDUSTRIES, INC.
NATIONAL ELECTRIC INSTRUMENT DIVISION
92—21 Corona Avenue • Elmhurst 73, New York

CIRCLE INFORM-A-GRAM KEY NO. 1043

NOW Lap Carbide, Dies, Tools and Polished Plastic Molds Without Expensive Diamond Compounds with TETRABOR

- Tetrabor is an oil paste of boron carbide especially compounded for lapping carbide tools and dies; steel tools, dies and gages as well as polishing plastic molds. It closely resembles diamond in hardness and specific weight.
- CUT LAPPING COST—Tetrabor costs much less than diamond and can be used in 99 per cent of the applications formerly requiring diamond.
- INCREASE PRODUCTION — Faster acting Tetrabor permits its use in place of conventional compounds at same cost. Gives superior finish.
- Available in 100 gram tube in a range of grits to suit every application.

Dealer inquiries invited.

Order your trial kit containing a 50 gram sample of 12 grits. Shipped Post Paid for $15.50. Or send for free literature and price list.

TITAN TOOL SUPPLY CO.
Box L, 1419 Hertel Avenue, Buffalo 16, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1044

New Ideas in Cutters

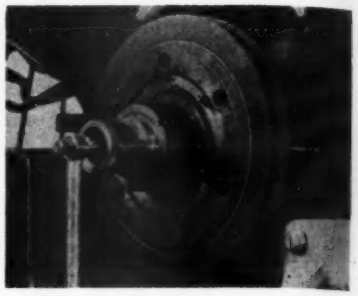
★ Designers and manufacturers of H. S. S., tantung, and carbide cutters based on cost saving principles. Form relieved, hard faced cutting edges, throwaway inserts, welded bodies, semi-finished blanks, clamped-on blades. Serving America's metal working, carbon, graphite, valve, and instrument manufacturers. **Write or phone LUdlow 8400 for latest catalog.**

NIAGARA CUTTER
Division of Bollier-Damerell, Inc.
338 Niagara St., N. Tonawanda, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1045

Product News

Portable Balancer



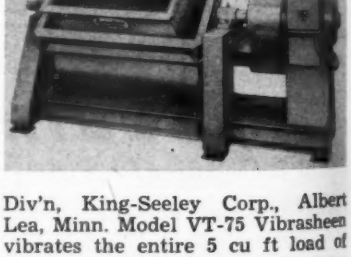
A New Precision Portable Balancer for grinding wheels offers fast, accurate balancing without removing the wheel from grinder. This makes possible an 80% savings in grinding operations. It's designed to achieve precision balance and return the machine to production in less than 30 min. Aero Supply Mfg. Co. Inc., Corry, Pa., or Circle No. P53.

New Air Filter

A New Compressed Air Filter removes moisture, oil, and contamination by separation rather than absorption. It's for use on compressed air lines of up to 125 psig that have been clogged with oil, dirt, and moisture. Write Fram Corp., Providence 16, R.I., for a bulletin, or Circle No. P54.

Deburrs and Cleans

A Vibratory Finishing Machine for deburring, descaling, cleaning, and burnishing metal parts has been announced by Almco, Queen Products



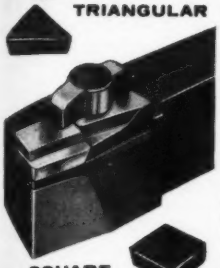
Div'n, King-Seeley Corp., Albert Lea, Minn. Model VT-75 Vibrasheen vibrates the entire 5 cu ft load of parts and media. The company supplies bulletin, or Circle Inform-A-Gram No. P55.

New Positive Rake ARMSTRONG

Carbide Insert TOOL HOLDERS

with proven ARMSTRONG Design Features

TRIANGULAR



SQUARE

Rapid Indexing—easily accessible from top or bottom.

Replaceable Seat of Hardened Tool Steel.

Huskier shanks of Heat Treated Alloy Steel.

Shank Styles for both Conventional and Open Side Tool Posts.

For every day tool room and production turning on engine lathes, turret lathes and screw machines. Permit increased cutting speeds of carbides while eliminating carbide tool grinding.

Low cost positive rake ARMIDE "throw away" inserts provide three or four cutting edges per insert. Available in three grades of ARMIDE: 350, 370 or 883.

Buy positive and negative rake Carbide Insert Tool Holders by ARMSTRONG—leader in tool holders and cutting tools for over sixty years.

Buy ARMSTRONG TOOLS from your Industrial Distributor

Write for Circular

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5220 W ARMSTRONG AVE · CHICAGO 46, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 1051

ACTUAL SIZE

PROCESS: Converting 250 handmade parts to short-run stampings

SYSTEM: Dayton Rogers' method of utilizing temporary tooling

● This lock-cap brush holder formerly cost a California manufacturer of floor machines $1.00 each plus plating and installation (estimated at 50¢ each extra). Conversion to a short-run stamping saved $66.20 for the first 250 pieces. Subsequent orders were 90% less.

Got a stamping problem? Can converting from a casting, molding, fabricated part or complicated assembly save you? In terms of cost, time, labor and piece-price? In terms of pilot model, limited or production run? Analyze the part. Then let us quote on your print or sample . . . any quantity . . . no obligation.

DAYTON ROGERS
Manufacturing Company

MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 1052

NEW HOLOMATIC DRILL UNITS

with 4" – 6" or 10 INCH STROKE CAPACITY

To meet your ever increasing production tempo, Hause has developed two new drill units with 6" and 10" stroke capacities. As was the original time-proved 4" stroke model, the new Holomatic drill units are completely self-contained reciprocating quill type power devices for use on *production drilling, reaming, centering, facing,* etc. They can be used individually or in groups with manual or full automatic cycling. Units are air actuated, precisely controlled hydraulically. Available with six standard drives, motor horsepowers to 2 H. P., spindles are interchangeable for single or multiple head applications.

- **Concentric construction assures accuracy, longer life**
- **Honed, polished and chromed thrust piston and quill**
- **Up to 3600 four-inch stroke cycles per hour**
- **Automatically filled hydraulic system**
- **Built-in hydraulic oil filter system**
- **Sealed—oversize ball bearings on spindle and shaft**
- **Sealed unit construction *permits mounting in any position***
- **Mounting surfaces on three sides for installation flexibility**

Find out now—why Holomatic drill units are setting the pace in progressive production plants across the nation. Your Hause representative will gladly demonstrate their multiple dollar-saving efficiencies right in your plant.

Write today *. . . for demonstration or additional information, specifications and prices on the new Holomatic "Air-Hydraulic" Drill units, "Balanced Air" Threading units, "Lead Screw" Tapping units, complete machines or full line of machine bases and accessories.*

Hause
MACHINES, INC.
MONTPELIER, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1053

LIFTING DEVICES
for
FAST-SAFE-BETTER
Material Handling
of
• SHEETS
• COILS • BOXES
• MOLDS
• DRUMS • PALLETS
400 MODELS
Prompt Delivery
Write for full particulars
H. L. Bushman Co. 100-A West Central Ave. Roselle, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1061

HARDNESS TESTING
has been done with the **SCLEROSCOPE**
Since 1907
•
THE SHORE INSTRUMENT & MFG. CO., Inc.
90-35 Van Wyck Expressway
Jamaica 35, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1062

JIG BORING
and
Large Precision Machining
Done to your specifications
We Have
22 Jig Borers
KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1063

CAMS ALL TYPES MADE TO YOUR SPECS

"Cam Calculating Service"
Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres
EISLER ENGINEERING CO., INC.
732 SO. 13TH ST., NEWARK 3, N. J.

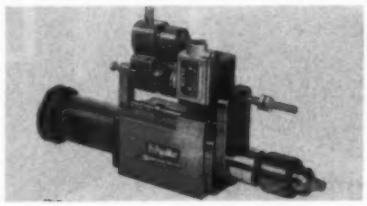
CIRCLE INFORM-A-GRAM KEY NO. 1064

MINIATURE DRILL BUSHINGS
Hole Sizes—No. 80 to 3/32"
O.D. 3/32" to 13/64"
Lengths 1/4" to 3"
.0002 Tolerance on I.D.
O.D., and Concentricity
Specials to your specifications
WRITE FOR CATALOG
PREBCO BUSHING CO.
14702 East Arrow Hwy., Baldwin Park, Cal.

CIRCLE INFORM-A-GRAM KEY NO. 1065

Product News

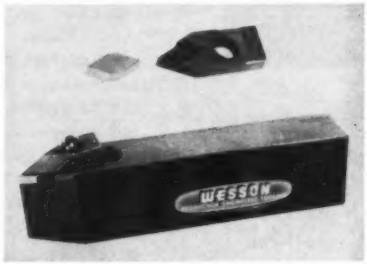
Sturdy Drilling Units



Two New Drilling and Tapping Units feature all cast iron and steel construction, chrome plate quill, and six-splined drive spindle. Both have 2" stroke with drill and tap capacity of ¼" in steel. Model S-200-EHB (pictured) is a standard belt driven unit. Hypneumat, Inc., 647 W. Virginia St., Milwaukee, Wis., or Circle Inform-A-Gram No. P56.

Insert Holder

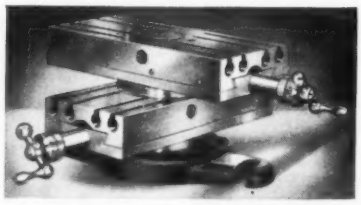
A New Standard Multicut Insert Holder line for tracer turning was designed so all component parts, except the holder shanks, are now standardized and interchangeable.



One anvil-locator, clamp, locking screw, taper-head screw, and diamond-shaped insert fit all four holders. Get details from Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, or Circle Inform-A-Gram No. P57.

Versatile Table

This Universal Table provides for almost unlimited position control and affords flexibility for milling, drilling, and use on the shaper. Both upper and lower slides have graduated swivels and may be turned through



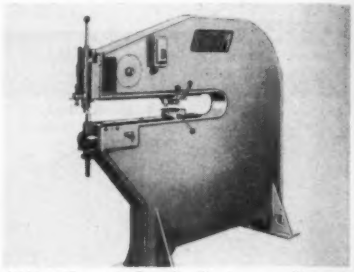
full 360°. Has 4" x 8⅞" work surface and 4" maximum travel. South Bend Lathe Works, 425 W. Madison St., South Bend 22, Ind., or Circle Inform-A-Gram No. P58.

Milling Cutter

Cut Milling Time in Half through tool changing and setup with a new milling cutter designed to use throwaway type, indexable cemented carbide insert blades. Also eliminate necessity of regrinding. Inserts provide four to eight cutting surfaces. Super Tool Co., a division of Van Norman Industries, 21650 Hoover Rd., Detroit, or Circle Inform-A-Gram No. P59.

Machine Shears & Forms

A New Shearing, forming, and piercing machine, Model TE-281 Metlmaster, has a 9/32" maximum edge cutting capacity in mild steel plate and 3/16" in stainless steel, and



49¼" throat depth that permits cutting circles up to 48" dia inside the throat. Write Lennox Tool & Machine Builders, Dept. MM-1162, Lima, Ohio, for details, or Circle Inform-A-Gram No. P60.

Versatile Air Router

Make Partial or Complete Cuts through metals, plastics, or honeycomb materials with a new air-powered router. Features positive-locking depth adjustment, oversize front end bearings, and full-length full-grip collet, rated capacity of ¼" collet. Buckeye Tools Corp., 5015 Springboro Pike, Dayton, Ohio, or Circle Inform-A-Gram No. P61.

Direct-Air VALVES for Easy AUTOMATION

COMPLETE VALVE CATALOG Ready!

MEADMATIC

4-way pilot-operated air valve for direct or remote control—no delicate electrical hookup needed.

A light momentary touch on limit switch actuates main valve piston—response is instantaneous! Catalog free.

Write today!

MEAD SPECIALTIES COMPANY

4114 N. Knox Ave., Dept. HA-89, Chicago 41, Ill.

PATHFINDER IN AIR POWER AUTOMATION

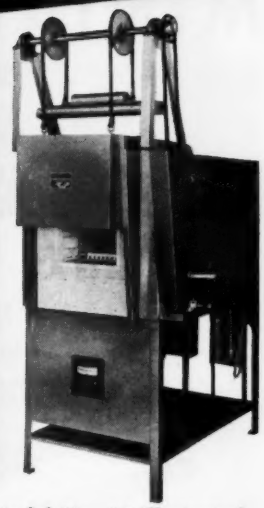
CIRCLE INFORM-A-GRAM KEY NO. 1071

HUPPERT Floor Model Furnaces

Built in 28 Standard Sizes

- Continuous operation to 1850°F. — intermittent to 1950°F. — for 2300°F. on special order.
- Complete with indicating electronic contraller.
- Tight-sealing, wedge-type door.
- Standard for 220 V. AC, single or 3 phase operation—110 V. or 440 V. on special order.
- Multi-insulation for maximum efficiency.

Request literature on complete line of Huppert Furnaces.



Model No. 16 Illustrated
Inside Dimensions 12" W. x 8" H. x 18" D.
$1050.00 complete

K. H. HUPPERT CO.
Manufacturers of Electric Furnaces and Ovens
6820 Cottage Grove Avenue • Chicago 37, Illinois

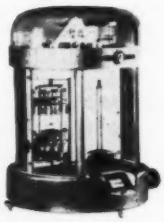
CIRCLE INFORM-A-GRAM KEY NO. 1073

VARIMEX Ltd.

POLISH COMPANY FOR FOREIGN TRADE

Wilcza 50/52, Warsaw, Poland
CABLE: Varimex Warsaw

Sole Exporters of:



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FOR INFORMATION CONTACT:

COMMERCIAL COUNSELOR
POLISH EMBASSY
2125 Leroy Place, N.W.,
Washington, D.C.

VARIMEX PTHZ WARSZAWA

CIRCLE INFORM-A-GRAM KEY NO. 1072

DUSTKOP "520"

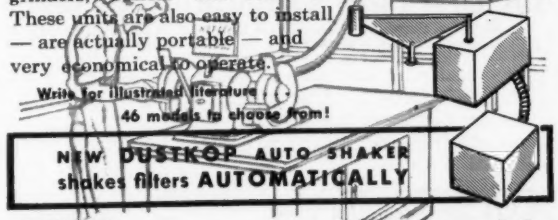
designed to collect dust from single machines

portable— easily installed

DUSTKOP STOPS DUST

Self-contained Dustkop models, like the "520," are practical and effective in collecting dust from single machines. They're designed specifically for service with surface grinders, tool and cutter grinders, offhand grinders, buffers and other small wheel equipment. These units are also easy to install — are actually portable — and very economical to operate.

Write for illustrated literature . . .
46 models to choose from!



NEW DUSTKOP AUTO SHAKER shakes filters AUTOMATICALLY

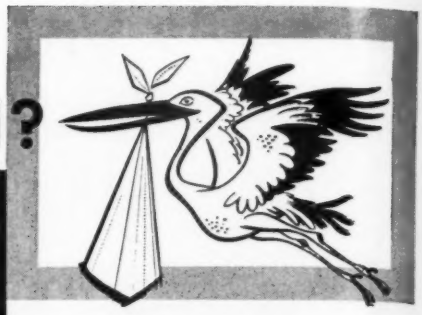
AGET manufacturing company
1394 E. Church Street, Adrian, Michigan

ask for details

CIRCLE INFORM-A-GRAM KEY NO. 1074

ARE YOU PROPERLY GEARED FOR

MINIATURIZATION?



USE THE PERFECT COMBINATION
For **MICRO-DRILLING**

SPHINX

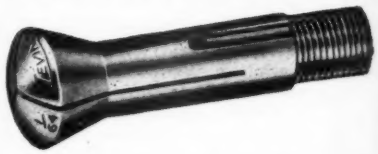
HIGH SPEED STEEL
MICRO-DRILLS

Drills from .0016" to .0591" are stocked in increments of .0004"(.01 mm). From.0610" to .1181" in increments of .0020" (.05 mm). Left hand micro-drills for use on Swiss type automatic screw machines. Short flute center drills. Send for Bulletin "Q" listing complete line of drills or Catalog M listing collets as well as full line of instrument lathes and accessories.

Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, California.

LEVIN ®

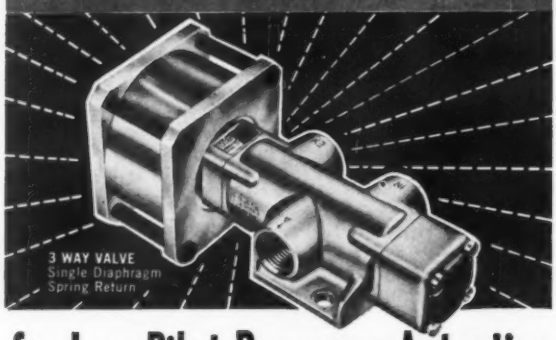
SUPER PRECISION **COLLETS**



Super precision collets for jewelers type lathes. Ideal for holding micro-drills or other parts where concentricity is important. Available from stock in complete range of sizes from .004" (.1 mm) to 5/16" (8.0 mm).

CIRCLE INFORM-A-GRAM KEY NO. 1081

VERSA | Diaphragm Actuated Valves



for Low Pilot Pressure Actuation

■ Versa Diaphragm Valves can be actuated by pilot (or signal) pressures as low as 5 PSI on double diaphragm types and as low as 10 PSI on standard spring return models.

Versa Diaphragm Valves are available with side port bodies or for manifold mounting, and in sizes from 1/8" thru 1" NPT in 2-, 3-, 4-, and 5-way types, and for pressures from partial vacuum to 500 PSIG.

All Versa Valves are triple pressure and functionally tested under water for guaranteed leakproofness.

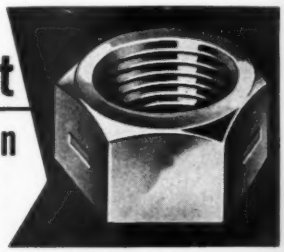
VERSA

■ Write Today for your free copy of bulletin 259

VERSA PRODUCTS COMPANY INC.
247-A SCHOLES STREET
BROOKLYN 6, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1082

NEW Centerlock Nut



saves production time... speeds application

Here is a new low cost lock nut that can be applied from either end, double chamfered, with the locking feature in the center. The greater speed in application of these Centerlock Nuts can make definite savings in production time and provide low cost fastening. Ideal for customer assembled products.

The New Centerlock...

● Can be automatically fed ● Will lock wherever turned on bolt ● Does not depend on friction against work for locking ● Can be applied from either end ● Will not damage bolt threads ● Available in steel, Brass, aluminum or stainless on special order ● Offered in finished series, double chamfered from ¼" thru ⅞" in fine or coarse threads. Machine screw sizes #8, #10, and #12 also available. Heavy series made to special order only ● Also in closed and open end acorn type ● Large inventories carried for immediate shipment. 119

Write for samples and NEW CATALOG today

GRIP NUT COMPANY
107 Maple Ave. South Whitley, Indiana

CIRCLE INFORM-A-GRAM KEY NO. 1083

COUNTERSINKING WITH CARBIDE

—Steel, titanium, abrasive non-ferrous materials, including fibre glass panels, heat-treated steels, long runs of any material?

HERE'S HOW YOU SAVE WITH CRAIG THREADED-SHANK CARBIDE TIPPED COUNTERSINKS!

Reverse Spotfacers

Reverse Countersinks

Consider the original cost of carbide cutter, *plus* fewer resharpenings per run, *plus* fewer cutter changeovers, *plus* more burr-free holes...

divided by the total number of parts...

equals the lowest cost per hole—the only cost you care about!

The same profit formula works with Craig Reverse Countersinks and Spotfacers, too! Write for catalog and prices.

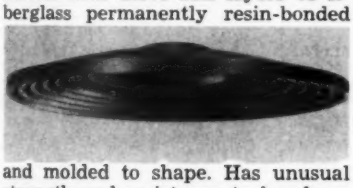
CRAIG TOOLS, INC.

133 Lomita Street • El Segundo, California
CIRCLE INFORM-A-GRAM KEY NO. 1091

Product News

Rugged Grinding Wheel

A New Dished-Depressed Center Grinding Wheel is ruggedly reinforced with three full layers of fiberglass permanently resin-bonded

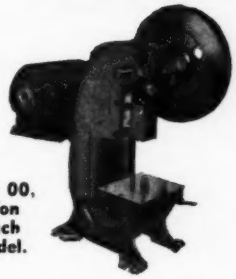


and molded to shape. Has unusual strength and resistance to breakage and comes in 7" and 9" stock sizes. The American Emery Wheel Works, Red Bridge, Providence, R.I., or P62.

Power Package

A Two-Stage Hydraulic Power Package delivers from 600 cu in of oil/min at 100 psi to 50 cu in of oil/min at 10,000 psi. Has two gal reservoir capacity, with 1¼ gal of usable oil. Valves, control, and accessories are available for mounting for specific requirements. Get a bulletin from Owatonna Tool Co., N. Cedar St., Owatonna, Minn., or Circle No. P63.

There's no price tag on the EXTRAS that make



No. 00, 2 Ton Bench Model.

PRESS-RITE O. B. I. POWER PRESSES

The Choice of Leading Press Users*

No. 40, 40 Ton Wide Bed

All semi-steel press frames are cast in our own foundry under rigid quality control. 60 Ton and 85 Ton models have exclusive PRESS-RITE built in tie rods. Every model from 2 Ton through 85 Ton is designed for maximum rigidity to give you longer die life. Model 40, Wide Bed has specially reinforced all steel frame.

Other Extra Quality Features that are Standard on PRESS-RITE Presses Include:
Extra long full vee ramways with gib adjustments on both sides on all models from 15 Ton up; rugged main, connecting rod and anti-friction flywheel bearings; positive 4 point engagement clutch; extra large die space and many others. Variations include longer stroke, greater shut height, air clutch, back gearing, deep throat, wide bed and horizontal models and others.

No. 85 85 Ton.

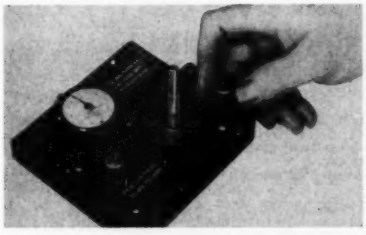
*PRESS-RITE Users include: General Electric, Westinghouse Electric Corp., Century Electric Co., Ford Motor Co., Allis-Chalmers Mfg. Co., Voi-Shan Mfg. Co., Miami Window Corp., R. Russell Co., Eastman Kodak Co., Cummins Engine Co., Inc.

Investigate the HAVIR (formerly Diebel) Hi-Production Automatic Presses from 5 Ton to 200 Ton. Our practical engineers will help you select the most efficient solution to your stamping problems at no obligation. Write for details.

Ask your PRESS-RITE DEALER or write for Bulletin 958.

Sales Service Mfg. Co.
2361 University Ave., St. Paul 14C, Minnesota
CIRCLE INFORM-A-GRAM KEY NO. 1092

Five-Way Gage



Gage Splined Shafts with the Splinedicator that combines the function of five gages, replacing Go and No-Go composite rings and master plugs for each, and offering a master ring to check spline gage for internal spline. Accuracy to within 0.00005". Vinco Corp., Detroit, or Circle Inform-A-Gram No. P64.

Prevent Rusting

A New Water-Soluble Metal Coolant Stops rusting, resists rancidity, and reduces threat of dermatitis. Cold Stream doesn't hold dirt in suspension so it stays clean for weeks, provides superior finishes, and extends tool life. Get information from Johnson's Wax, Racine, Wis., or Circle Inform-A-Gram No. P65.

CUMULATIVE EDITORIAL INDEX FOR 1959 ISSUES

TOOLING & PRODUCTION Magazine

The number of subjects in which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

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SAVE THIS AD FOR FUTURE REQUIREMENTS—DEALER INQUIRIES INVITED

NEW SIZES ADDED DAILY . . . IF NOT LISTED HEREIN — INQUIRE

WHY WAIT

DELIVERY FROM STOCK

SPECIAL Right & Left Hand High Speed Taps-Dies & Thread Plug Gages

SIZE	THREADS PER INCH
0000	160
000	120
00	90-96-112
0	56-64-72-76-80-90
1	48-56-60-64-80-90
2	48-52-54-56-60-72-80
3	36-40-60-64-72-80
4	30-32-38-42-44-56-60-64-72-80-90
5	22-27-30-32-36-38-42-48-50-56-60-64-72-80
6	24-28-30-36-38-42-44-48-56-60-64-72-80
7	28-30-32-34-36-38-40-48-64
8	24-26-28-30-38-40-44-48-56-60-64-72-80
9	24-28-30-32-36-40
10	18-20-22-26-28-30-36-40-48-56-60-64-72-80
11	20-22-24-28-30-32-36
12	20-22-26-27-30-32-36-38-40-48-56-60-64-72-80
13	20-22-24-28-32
14	14-16-18-26-28-30-32-36-40
15	18-20-24-28-32
16	16-18-20-22-24-28-32-36
17	16-20
18	16-18-20-24-32-40
19	18-20
20	14-16-18-20-24-32
22	16-18-20-24
24	14-16-18-22-24
26	14-16-20-24
28	14-16-20
30	14-16-20
1/16	56-60-64-72
5/64	56-60-64-72
3/32	32-36-38-48-50-56-60-64
.107	52
7/64	36-40-42-44-48-50-56
1/8	30-32-36-38-40-48-56-60-80
.132	50
9/64	30-32-38-40
.148	38
5/32	24-26-28-30-32-36-38-40-50
11/64	24-26-30-32-36-38-40
3/16	12-18-20-22-24-26-27-28-30-32-36-40-48-56-64-72
.198	24

SIZE	THREADS PER INCH
13/64	24-28-30-32-36-40
7/32	20-22-24-26-27-28-30-32-36-38-40
.227	24
15/64	20-22-24-28-36-40
1/4	10-12-14-16-18-22-23-24-25-26-27-30-32-36-38-40-48-50-56-60-64-72-80
17/64	12-18-20-24-27-28-32
.277	40
9/32	16-18-20-24-26-27-28-32-36-40-46
19/64	18-24
.300	28
5/16	12-14-16-20-22-26-27-28-30-32-36-40-48-50-56-64
21/64	16-18-20-24-36
11/32	16-18-20-22-24-26-27-28-32-36-40
23/64	16-24
.365	28
3/8	12-14-18-20-22-26-27-28-30-32-36-40-44-48-56-64
25/64	14-16-18-20-24-27
.402	24
13/32	12-14-16-18-20-24-27-32-40
27/64	14-20-24-28-32-36
7/16	10-12-16-18-22-24-26-27-28-30-32-36-40-48-56
29/64	12-14-16-20
15/32	12-14-20-24-27-28-32-36-40
1/2	10-11-12-14-16-18-22-24-26-27-28-30-32-36-40-44-48-56
33/64	12-13-20-24
17/32	10-12-13-14-16-18-20-24-27-28-32-40
.550	24
9/16	10-13-14-16-20-24-26-27-28-30-32-36-40-48
37/64	10-12-18-20-27
19/32	12-18-20-24-28-32-36-40
5/8	9-10-12-13-14-16-20-24-26-27-28-30-32-36-40-56

SIZE	THREADS PER INCH
41/64	11-18-24
21/32	10-11-18-20-24-27-32-40
11/16	10-11-12-14-16-18-20-22-24-27-28-30-32-36-40
23/32	11-12-16-18-20-27-32-36-40
47/64	10-12-16-18-20
3/4	8-9-11-12-14-15-18-20-22-24-26-27-28-32-36-40
49/64	10-16-18-20
25/32	10-12-16-18-20-24-27-32-40
.800	16
13/16	8-10-12-14-16-18-20-24-27-28-32-40
.835	16
55/64	6-12
27/32	9-10-18-20-24-27-32-40-48
.850	14
7/8	8-10-11-12-13-16-18-20-24-26-27-28-32-36-40
29/32	9-12-14-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-27-28-32-40
31/32	9-12-16-18-20-24-28-32
1	5-9-10-11-12-16-18-20-24-26-27-28-30-32-36-40-48
1-1/32	8-12-14-16-18-20
1-3/64	12-14-16-18-20
1-1/16	8-10-12-14-16-17-18-20-24-27-28-32-40
1-3/32	7-8-9-12-14-16-18-20-32
1-1/8	8-10-14-16-18-20-24-27-28-32-40
1-5/32	7-8-9-12-14-16-18-20-24-32
1-11/64	18
1-3/16	7-8-10-12-14-16-18-20-24-32-40
1-1/4	8-10-14-16-18-20-24-27-28-32-40
1-5/16	6-7-8-10-12-14-16-18-20-24-27-28-32-40-48
1-3/8	5-8-10-14-16-18-20-24-32-40
1-13/32	12-16-18-20
1-7/16	6-8-10-12-14-16-18-20-24-27-28-32-40

SIZE	THREADS PER INCH
1-1/2	7-8-9-10-13-14-16-18-20-24-27-28-32-40
1-17/32	7-12-18-20
1-9/16	6-8-10-12-14-16-18-20-24-32-40
1-5/8	5-5½-6-8-10-11½-12-13-14-16-18-20-24-28-32-40
1-11/16	8-10-12-14-16-18-20-24-32
1-23/32	5-8-12-16-18-20
1-3/4	5-6-8-10-12-13-14-16-18-20-24-28-32-40
1.767	18
1.7715	12
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	12-16-18-20-32
1-15/16	8-10-12-14-16-18-20-24-32
2	4½-6-8-10-12-14-16-18-20-24-28-32
2-1/16	8-10-12-14-16-18-20-24-32
2-1/8	4½-8-10-12-14-16-18-20
2-3/16	8-10-12-14-16-18-20-24
2-1/4	4½-8-10-12-14-16-18-20-24
2-5/16	8-10-12-14-16-18-20-24
2-3/8	4-8-10-12-14-16-18-20-32
2-7/16	8-10-12-14-16-18-20
2-1/2	4-6-8-10-12-14-16-18-20
2-9/16	8-10-12-14-16-18-20
2-5/8	4-8-10-12-14-16-20
2-11/16	8-10-12-14-16-18-20
2-3/4	4-8-10-12-14-16-18-20-32
2-7/8	4-8-10-12-14-16-18-20-24-32
2-15/16	8-10-12-14-16-18-20-32
3	3½-4-8-10-12-14-16-18-20
3-1/8	4-8-10-12-14-16-20
3-3/16	4-8-10-12-14-16-20
3-1/4	4-8-10-11-12-14-16-18-20
3-3/8	4-8-10-12-16
3-1/2	4-8-10-12-16
3-3/4	4-8-10-12-16
4	4-8-10-12-16
4-1/8	4-8-10-12-16
4-1/4	4-8-10-12-16

Many more sizes in stock up to 6" dia.

LEFT HAND N.C. (USS)—N.F. (SAE) SIZES

SEE ABOVE SECTION FOR MORE SIZES

SIZE	THREADS	SIZE	THREADS	SIZE	THREADS	SIZE	THREADS
0	80	8	32-36	7/16	14-20	1"	8-12-14
1	64-72	10	24-32	1/2	13-20	1-1/8	7-12
2	56-64	12	24-28	9/16	12-18	1-1/4	7-12
3	48-56	14	20-24	5/8	11-18	1-5/16	6-12
4	36-40-48	1/4	20-28	11/16	11-16	1-3/8	6-12
5	40-44	5/16	18-24	3/4	10-16	1-7/16	6-12
6	32-40	3/8	16-24	7/8	9-14	1-1/2	6-12

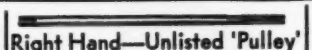
'OVERSIZE' and 'UNDERSIZE' TAPS

RIGHT AND LEFT HAND N.C. AND N.F. SIZES

MACHINE SCREW	#2 to #5	Plus or Minus	.003, .005, .010
MACHINE SCREW	#6 to #14	Plus or Minus	.002, .003, .005
FRACTIONAL	1/4" to 1-1/2"	Plus or Minus	.003, .005, .010 .015, 1/64, 1/32

Right & Left Hand—Unlisted 'Gun' or Spiral Pointed Taps

Size	Threads	Size	Threads
0	80 NS		
1	56 NS	7/8	9 NC, 14 NF
2	56 NC, 64 NF	1	8 NC, 12-14 NF
9/16	12 NC, 18 NF	1-1/8	7 NC, 12 NF
5/8	11 NC, 18 NF	1-1/4	7 NC, 12 NF
11/16	11 NS, 16 NS	1-3/8	6 NC, 12 NF
3/4	10 NC, 16 NF	1-1/2	6 NC, 12 NF



Right Hand—Unlisted 'Pulley' And Extra Length Taps

Size	Threads	Size	Threads
4	36-40 NC, 48 NF	3/8	24 NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	1/2	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	5/8	18 NF
		3/4	16NF
1/4	28 NF	Also Larger Sizes	NC & NF
5/16	24 NF		

UNLISTED Right Hand "Pipe" Taps

"NPT" Taper "NPT" Size	Thread	"NPS" Size	Thread	EX. LENGTHS "NPT" & "NPS" Size	Thread
1/16	27	1/16	27		
1/4	27	1	8		
2-1/2	8	1-1/4	11½	1/16	27
3	8	1-1/2	11½	1/8	27
3-1/2	8	2	11½	1/4	18
4	8	2-1/2	8	3/8	18
Also British		3	8	1/2	14
		3-1/2	8	3/4	14
		4	8	1	11½
		Also British		Also British	

Lefthand 'Pipe Taps' Taper and Straight

Size	Thread	Size	Thread
1/16	27	1	11½
1/8	27	1-1/4	11½
1/4	18	1-1/2	11½
3/8	18	2	11½
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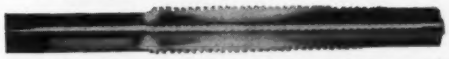

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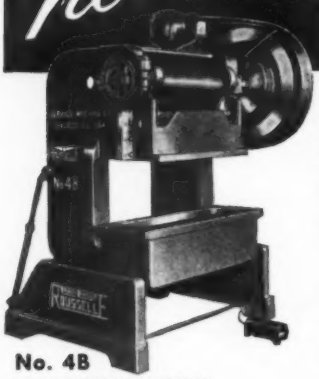

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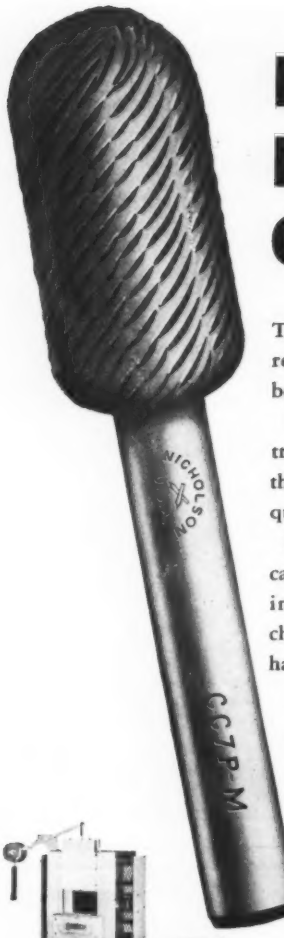

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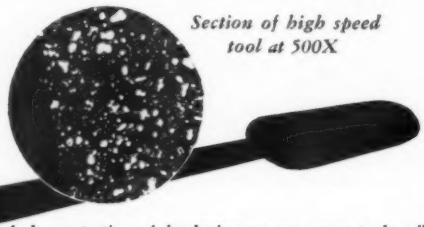

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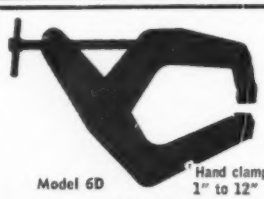

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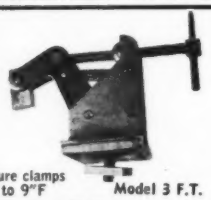

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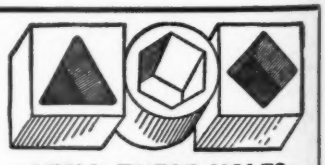

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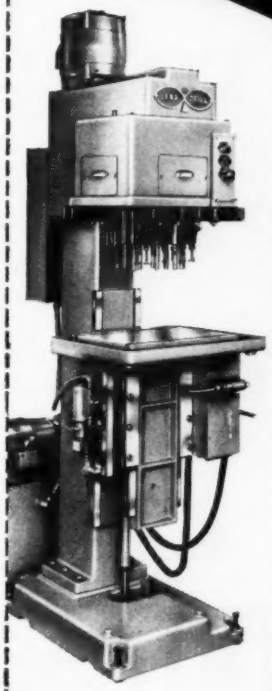

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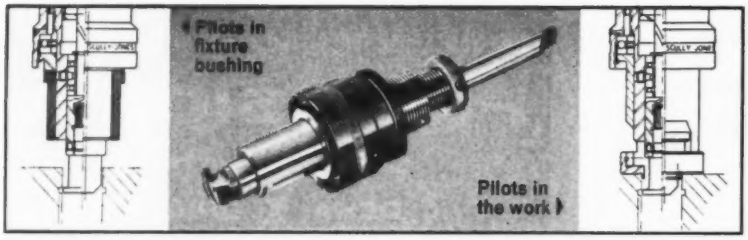

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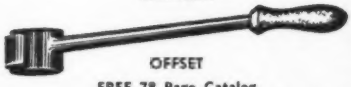

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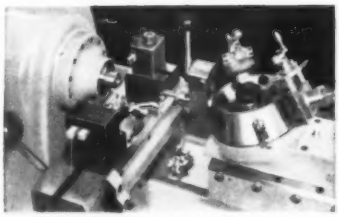

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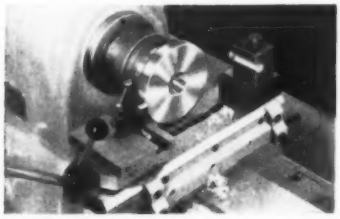
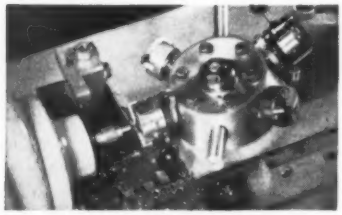


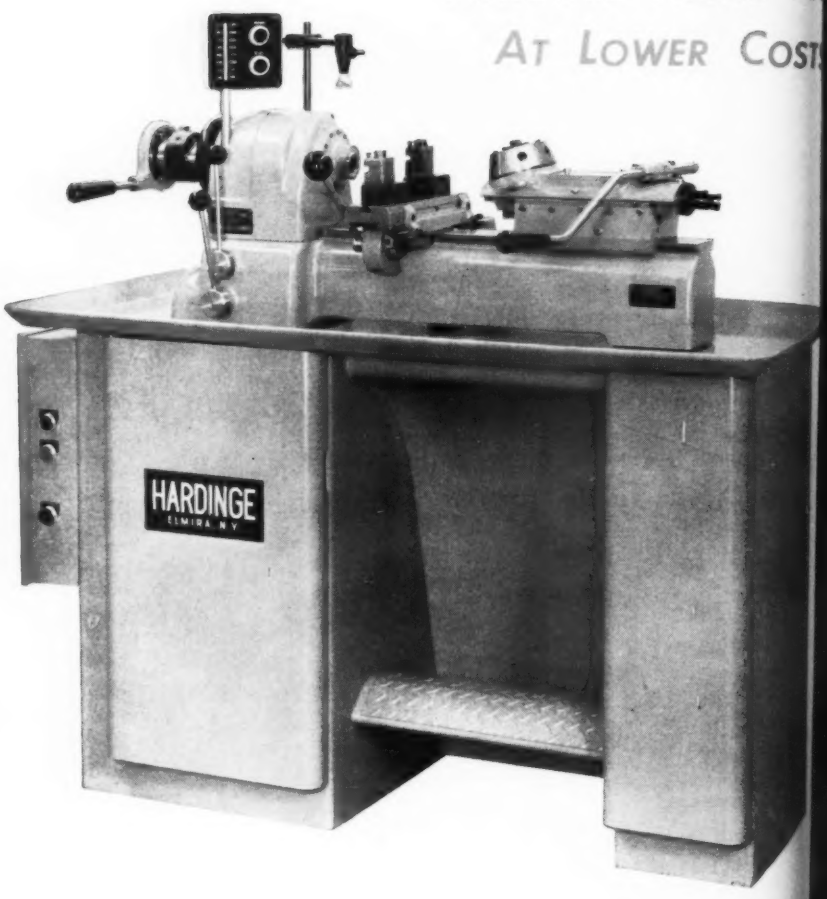
STEP CHUCK WORK

For Rapid and Accurate Holding of Tubing, Castings, Moldings, Stampings and Machined Parts. Capacity to 6".



BAR WORK

When Equipped with Bar Feed, Machine is Ideal for Bar Work.



CIRCLE INFORM-A-GRAM KEY NO. 118